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AMERICAN POTASH INSTITUTE, INC.
INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

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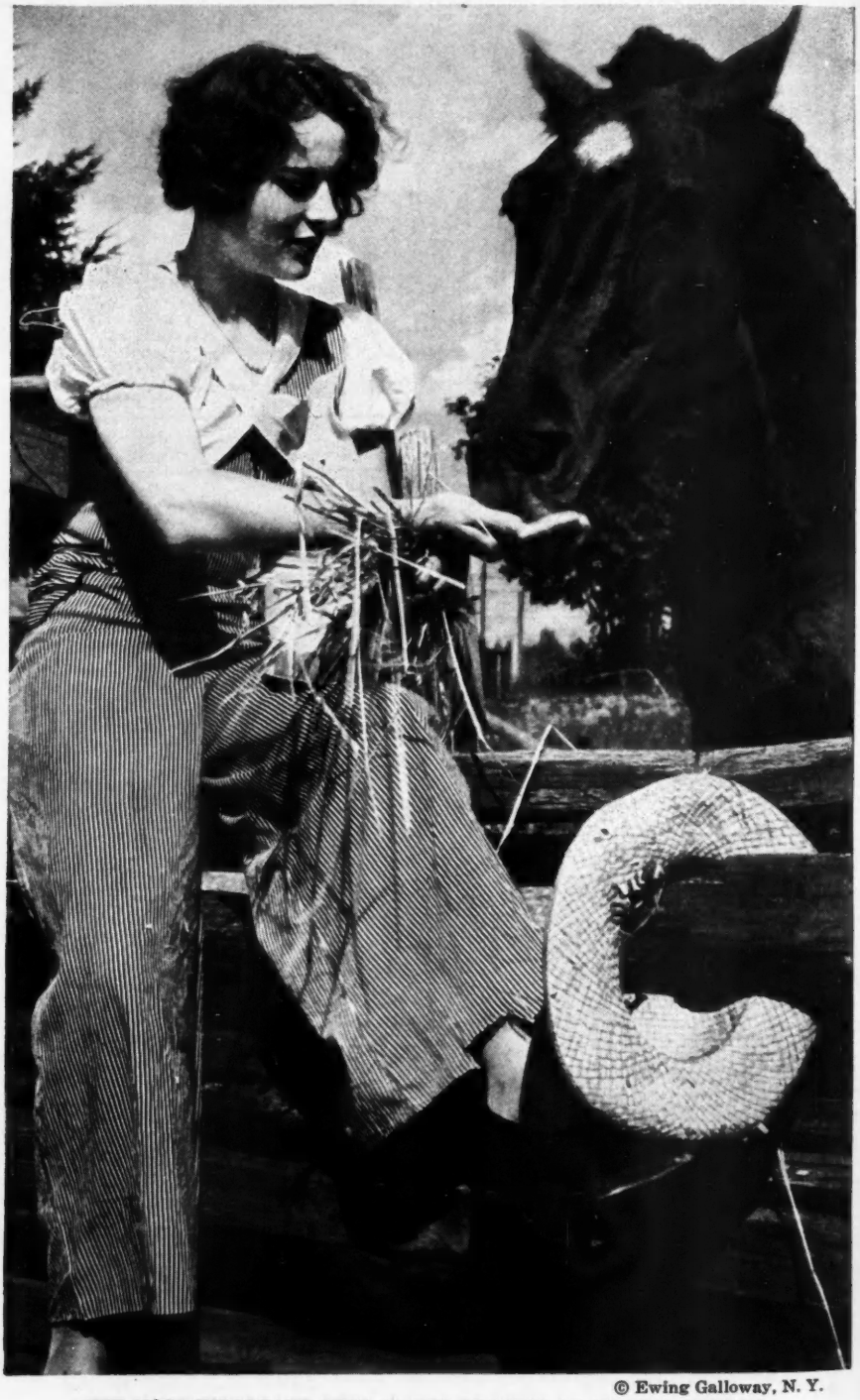

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THE MOST IMPORTANT STEP IN THE PROCESS OF MAKING FRIENDS.

Better Crops with PLANT FOOD

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Flowers bloom again in the—

Sand Country

Jeff McDermid

IF THERE be one thing to console me in a year of low mean temperatures and excess moisture, it is the comfortable sense of security I possess concerning the crop prospects of my old friends in the sand country. By "sand country" I do not mean the long-leaf pine barrens of Dixie nor the shifting dunes that border the great blue seas of our midlands. Instead my thoughts lie with the farmers who reside along the river valleys and on the beds of extinct glacial lakes up in the northern rye and potato belt.

One more drouth in that region would change county agents permanently into relief workers and breed more righteous radicals than Messrs. Townley and Townsend ever created. It is of course true that even in scorching seasons of dribbling rainfall some of those old buddies of mine come through with a comparative oasis in the Sahara of despair. By dint of better seed, spring plowing, cultipacking and rolling, legume culture, and proper fertilization, they find better use for their silicate surplus than in the mixing of mortar or the manufacture of glass and sandpaper; and the soil-conserving payments have provided their cows with alfalfa and their land with nitrogen. So a few of them might undergo one more dry summer siege among the sand-burs without complete loss of morale. But still old

Sol and Jupe Pluvius have a strangle hold on the majority.

It is evident to all weather-wiseacres that I am taking a long shot in the dark and perhaps counting a few turkeys before Thanksgiving, for the favorable season thus far for the go-getters on the sands may turn by September into another sizzling holocaust for hoe crops. But having consulted ground hogs, soothsayers, medical almanacs, and my own unfailing hunches, I feel as safe in rejoicing over the situation in the "quartz quarries" as any writer can be who sticks out his neck in public.

If I flop in my surmises, I flop on the side of optimism; and optimism is a trait which all farmers have but which they seldom admit or tolerate in any of their friends. My proof of this statement is simply that every dust-bowl population rises on its haunches and offers free rides on a rail to those who suggest regional abandonment. Home is always "sweet" home no matter if there happens to be more sand than sugar in the porringer.

They resist the resettlement idea vehemently on the one hand and send piteous pleas to congressional feed lobbies meanwhile. They are Americans and therefore strong for rehabilitation instead, adhering to the traditional right to stick it out with a loan rather than to desert the desert.

AND probably many of them are right. For maybe it is as sound to improve farms under the stress of human emotions as it was to exploit land resources for material expansion. At any rate our money is as safe spent on troublesome soils as it is shipped to war zones abroad. If we are bound to invest in nitrogen, let's put it into grass rather than nitroglycerin. Let's grow sod for beefsteak instead of a green mound to cover a soldier's grave!

As I was saying before I was interrupted, it looks like a bonanza year for the boys among the jack pines. I have recently been up there celebrating with them on their stock of rye—not in the cellars, but in the bins.

It doesn't take so long to get there as it used to when a team got all lathered up pulling a narrow-tired buggy hub-deep in "corn meal." Cement arteries connect the county seats and stabilized roads penetrate into the townships. They even cross the big slough where too much water created peat soils on the edges of equally unproductive areas of sieve-like, bone-dry blow sand. Fertility was leached out of the one kind and baked out of the other until the experiment stations took a hand.

WE had three kinds of experiment stations on the sands. There were the few independent fellows who brought sound ideas from "York state" or read up religiously so as to become cultured in agriculture. Then there were a few outstanding supervisors of county asylum farms, who believed that public funds might be spent on worn-out land as effectively as on broken humanity. They found that both the sick soil and the weak mind benefited thereby, the former by the labor of the inmates, and the inmates by a reasonable amount of ozone, exercise, and sunshine vitamins. In fact some asylum farms proved there was no excuse for lack of alfalfa on the sands, for even the folks with weak noodles grew big nodules. The third type of experimental farm was run by the land-grant college.

I began attending these "rotation revivals" back in the days when there was only one car for every ten persons—and they all got into it to join the "mourners" at the station farm. There were no loans to lean on without security in those times; and if there was a choice between poverty or professors, they chose the latter.

A good many farmers staved off the sheriff by what they learned from the professor, even though it was often a graphic lesson in what not to do rather than a magic key to new riches. And by the way, if we all practiced not doing the things that harm us, all

soils would be stronger and the world would be at peace. So a few negatives sometimes make a positive.

En route to the sand station one always stirred up a few Indians—or "Injuns" to be exact. Nothing whatever to be alarmed about, I assure you, as they lived in oval, canvas-covered wigwams a few rods off the road and sold willow baskets. Sales were slim because folks in those parts didn't have much to put into baskets.

WHEN the state began to settle up, the government shoved the Injuns off the clay loams and black prairie soils as fast as European colonizers arrived, which was the true American system of being extra nice to folks from abroad. The Injuns squatted on the sands or sploshed through the peat marshes hunting ducks and furs, but they never tried to do any farming. Wisely enough, they left that for the white folks, and then when some settler quit his premises after a crop failure, the tribesmen moved into the bleak shanty and kept on making more baskets. As a matter of fact, baskets were the main surplus crop of the sand area, so it was the redskins and not the white brothers who were guilty of overdoing production thereabouts.

THE advent of the auto did as much for the sand country as our scientific advancement in "cropology." The buzz-buggy brought good roads, and good roads brought the city curio hunters, tourists, and summer boarders. The newcomers with some leisure and spare cash enlivened the basket business; in fact, the conservative aborigines were forced into all manner of shrewd souvenir craftsmanship, taking a cue from the professional hounds.

Our tribesmen were mostly Winnebago Injuns, but the beadwork, headdresses, and moccasins they now contrive to sell have a decidedly un-Winnebago, mail-order aspect—more like Arapahoe, Aztec, or Navajo—with a medley of color and design truly painful to your student of Injun lore. They have gone Hollywood in everything, while baskets no longer mark the limit of their commercialism.

Moreover the promoters of wilderness settings have induced the "savages" to hold costume dances nightly at the frequent roadhouses. I never patronize these pow-wows because my own memories of Winnebago womanhood hardly associate her generous type of figure with graceful terpsichorean abandon. Yet I presume city visitors possess far finer imaginations than one bred so far upstream.

In like manner the summer visitors have injected new life into many of our own race whose despair of acquiring sudden fortunes in rye and blueberries sent them after the tourist trade. Several enterprising young men have dug through all the musty attics and dusty closets in the county, load-

ing their plunder of ancient, smeary, and useless articles into light trucks, and then doing them over for the antique hunters.

Other weary sand-grubbers have given up the scrap with quack-grass and mustard and have gone in heavy for recreation dispensing. They put up some rustic benches and pergolas made from pine or tamarack, seed down a few square yards of spotty lawn, raise a few broilers in the spring, catch some crappies or perch in adjacent waters, spell out a frenzied farm name on a decorated board—and then wait for the first hungry crowd with a flat tire! Oh, yes, the best of them get regular customers on purpose, too, and many of them deserve a return trial.

ANOTHER, and thank heaven, a minor group, proceed on the theory that the sand country is naturally a thirsty place with a very low water-holding capacity. They are the mischief makers who have even put the Injuns to shame with liquid hell broth. At least Brother Little Skunk never mixed slough water, benzine, furfural, and peppermint juice to help tourists hit 90 miles an hour to get nowhere fast. These lousy birds have given town boards more headaches than their best customers and caused more financial loss than all the delinquent taxes ever piled up in the sand belt. No doubt their only contribution to unemployment problems has been making more jobs for highway policemen and prison guards. These bleary, rancid sink-holes of poison gas and rascality show clearly that what man does to the sand country is far meaner than any trick geology played on us—and sometimes a darn sight harder to correct.

I do not pretend that such irregularities are especially peculiar to the behavior in the light soil sections, for we have just such social sore spots in the rich belt too. But I maintain that somehow they look worse and have a more disheartening effect, just the same as when a sand-land farmer neglects his fertilizer and his livestock or lets his buildings sag and rot. It takes less to drag down a poor country than it does to tarnish the better kind. When folks cast their lot in a spot where it takes good brains, everlasting grit, and steady gumption to go places, we can't afford to get careless with chemicals. Better put them on the weeds!

We can thank our stars, however, that most of the young farm folks of these parts see the danger signals and prefer milk. This is surely mighty comforting, for if we can limit the sousing and cavorting to the old slinks who never made a nickel on the sands anyhow and encourage this 4-H club work and Future Farmer activity, our next generation of sand farmers will rise up and beat nature in more ways than one. It is this promising outlook in education and cooperation among the teen-age groups which gives me the most optimism about the long-time future of life in the sand country. Our county agents won't run so many soil tests for folks who need brain tests when that happens.

IT MAY seem strange, but I do not wonder overmuch why so many urban denizens flock in shoals up through the light soil belt. Of course, the fishing is fair if you are not too particular, but there are other points of merit.

The sand country is a place of beauty during any season from anemone time in April to golden-rod and iron-weed season in the fall. There are sun-flecked lakes with red-wing blackbirds perched on spiky cat-tail reeds. There are foaming trout brooks babbling through rough pastures. Here and there gaunt sandstone crags riven by wind and changing tempera-

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Atkinson Demonstrates That It Can Be Done

By F. J. Hurst
Editor, Agricultural Extension Service, State College, Mississippi

UNUSUAL achievement in any field usually brings its reward. Emerson once said that if you write a better book, preach a better sermon, or make a better mouse trap than anyone else, the world will beat a path to your door.

And he might have added that any farmer who could take over a neglected, run-down worn-out farm, during depression years, improve it and make money out of it, would be hailed as "a successful farmer" and farmers from far and near would visit him to see at first hand what he had done and how he had done it.

That is the story of W. S. Atkinson of Valley, Yazoo County, Miss. Ten years ago he proposed to buy a big farm near Valley. He asked some of the most successful farmers in the community what they thought about it. They advised him against it. "It broke everyone who ever owned it or tried to operate it," they told him.

Undeterred by their warning, Mr. Atkinson bought the place. It had been poorly farmed and badly man-

A rear view of the distributor showing that it cultivates the cotton as well as places the fertilizer.

W. S. Atkinson (left) shows how his tractor-drawn fertilizer distributor, which covers two rows at a time, places the fertilizer in bands about 2½ inches from the stalks.

aged. No crop rotation had been followed. No soil-improvement program had been practiced. No fertilizer was used.

As a result, crop yields were low. Previous owners had made only from one-fifth to one-sixth of a bale of cotton per acre. "Cotton will do fairly well up to July 1, and then quit," they said.

When Mr. Atkinson took charge of the plantation he immediately inaugurated a better system of farming. The land was plowed deeper. Crops were cultivated better. A definite soil-building program was mapped out and followed. Feed crops were grown. Soybeans were planted in all corn. Sufficient cowpeas and soybeans were grown to meet farm needs for hay. An additional acreage of cowpeas was planted for turning under for soil-improvement purposes. Nitrogen and phosphate fertilizers were used.

Under this system crop yields were increased. Yields of cotton, however, still were not satisfactory. So, in 1935, Mr. Atkinson arranged with the Delta Experiment Station at Stoneville to conduct fertilizer tests with cotton on his plantation. These tests revealed an acute need of potash, which when added to nitrogen and phosphate fertilizers, had a marked effect on increasing both yields and profits.

In the tests, check plots yielded 656 pounds of seed cotton per acre; the application of 100 pounds of nitrate of soda gave a yield of 725 pounds of seed cotton per acre; 100 pounds of nitrate of soda and 100 pounds of 20% phosphate produced 842.4 pounds; and 100 pounds of nitrate of soda, 100 pounds of 20% phosphate and 100 pounds of 50% muriate of potash produced 1,111.5 pounds per acre.

Why This Increase?

Mr. Atkinson gives three reasons for the increased yields resulting from the use of a complete fertilizer. First, the direct effect of potash as a plant food. His soil is deficient in this essential plant-food element and its application helps to supply this deficiency.

Second, potash had a marked effect in controlling rust. Fertilized cotton remained green and continued growing and fruiting 3 to 4 weeks longer than unfertilized cotton. On a neighbor's adjoining cotton field which received no fertilizer, cotton rusted badly and produced much lower yields.

Third, the fertilized cotton produced larger bolls.

Up to the time the tests were made, Mr. Atkinson had used only nitrogen and phosphorus fertilizers. The test

showed that a complete fertilizer was needed and that the application of potash increased yields more than either nitrogen or phosphorus.

In 1936, Mr. Atkinson planted 735 acres in cotton. One-half of this acreage was fertilized with 100 pounds of nitrate of soda as a side-dressing. The other half was fertilized with a complete fertilizer composed of 100 pounds of 20% phosphate and 100 pounds of 50% muriate of potash which was applied before planting, and 100 pounds of nitrate of soda per acre applied as a side-dressing. The complete fertilizer produced an average increase of 52 per cent.

This year Mr. Atkinson has 850 acres in cotton. He used a complete fertilizer as described above on every acre planted to cotton.

In describing the results obtained from fertilizers on Mr. Atkinson's farm, it is interesting to know that his farm is located in what is known as the foothills where soil has been washed in from the adjoining hills. This area extends all the way from Vicksburg to Memphis along the edges of the delta and brown loam areas of the state. Fertilizer tests conducted on other farms in Yazoo County and in other counties in the area described have uniformly shown a need for potash.

Uses Improved Machinery

Mr. Atkinson is probably the first farmer in Mississippi to purchase one of the recently invented fertilizer distributors which applies the fertilizer in bands about 2 inches from the seed or plant and at the best depth. This year Mr. Atkinson used this machine on plowed land to form the beds, plant the cotton seed, and apply the fertilizer all at one operation. The phosphorus and potash mixture was applied at planting time with the distributor, and the nitrate of soda was applied with the same machine as a side-dressing.

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The cotton left of the stake in this test field was waist high. It was fertilized with 600 pounds of 6-8-20 per acre. On July 2 when this picture was made, it had 2½ to 3 times the growth and fruit of the check plat at the right.

Shall It Be Soil-mining Or Soil-Building?

By C. J. Chapman
Wisconsin College of Agriculture, Madison, Wisconsin

WE here in Wisconsin are hearing a lot about soil conservation these days, and we wonder when we read and hear such statements as the following: "Wisconsin farmers have been living on their fat;" "We have skimmed the cream of virgin fertility;" "We are cashing checks on our bank account, the soil;" "Practicing an exploitative system of farming;" "Wasting our substance;" and "Mining our soils." We frequently hear the statement, "The nation that destroys its soil, destroys itself." Can it be true that we are really headed for national suicide? Are our Wisconsin farms being mined of their fertility?

Yes, it certainly is true that Wisconsin farms are losing fertility at an alarming rate. The average Wisconsin dairy farm is losing phosphorus and potash at a rate equivalent to 1 ton of 20 per cent superphosphate and at least 1 ton of 50 per cent muriate of potash each year. We have piled up in the past 50 years of farming a total loss of phosphorus and potassium equivalent to at least 50 tons of 20 per cent superphosphate and 50 tons of muriate of potash. We have labored under the false impression that in the livestock system of farming, where all crops grown on the farm were fed to livestock and the manure returned to the land, we were keeping up the fertility of our soils, keeping the plant food of our farms in circulation.

Potash hunger manifests itself in the white fleckings on the margins of alfalfa leaves. Alfalfa is a heavy feeder on potash.

But what evidence have we to show that we are actually losing fertility at the rate mentioned above? The best evidence, of course, of an unbalanced state of fertility is the fact that our soils are not as productive as they used to be. Clover seedings have failed in recent years; grain yields are lower; there

is more lodging of our grains. Yields of corn are not what they were in the early days. All this, in spite of improved and higher yielding varieties of corn and grain.

It is true that stable manure is a good fertilizer. Every effort should be made to save this valuable source of plant food and get it back on the land. The liquid portion is especially rich in nitrogen and potash. However, the supply of manure on the average farm is limited. There is not enough to go around. Even where every forkful of manure is saved and returned to the land, it is apparent that the level of fertility is not being maintained.

On the Wallace Landry farm, Thorpe, Wisconsin (colby silt loam), potash in the fertilizer in 1936 made a difference between almost a failure and a poor crop of barley.

Barley, 1936 (dry year):	**Alfalfa, 1937, first crop (wet year):**
Check plot — 1.9 bu.	**1,833 lbs.**
0-20-0 plot — 5.2 bu.	**2,166 lbs.**
0-20-10 plot—10.8 bu.	**2,833 lbs.**

The residual benefit to the alfalfa in 1937 made a difference of ½ ton per acre in the first cutting where the 0-20-10 was used.

Unavoidable Losses

We estimate that in Wisconsin we are producing from our 3,000,000 head of dairy cattle about 30,000,000 tons of manure each year. Valued at $3.00 a ton, this source of plant food on the basis of present prices for commercial fertilizers is worth nearly $100,000,000, yet authorities estimate that fully one-third of the plant-food constituents of manure is lost. In spite of the most careful handling of manure, there are unavoidable losses of plant food.

It would appear from the above that we are losing annually better than $30,000,000 worth of plant food from our soils, even where all crops grown on our farms are fed to livestock and manure returned to the land. And I have not included in the above the manure produced by beef cattle, hogs, sheep, or poultry, which if added would doubtless increase the net loss by $5,000,000. Wisconsin farmers are buying less than $1,500,000 worth of commercial fertilizers each year. This year, 1937, about 40,000 tons of commercial fertilizers were used on Wisconsin farms, which at $35 per ton amounts to $1,400,000.

We know that milk is rich in phosphorus. Eight thousand pounds of milk contain the equivalent of 100 pounds of 20 per cent superphosphate. A good cow will produce 8,000 pounds of milk a year; therefore, we are losing the equivalent of a 100-pound sack of 20 per cent superphosphate for each cow in our herds. If a farmer is milking 20 cows, he is losing the equivalent of 1 ton of 20 per cent superphosphate in the sale of milk.

Every 1,000 pounds of livestock sold from the farm carry the equivalent of 100 pounds of 16 per cent

superphosphate. We are selling calves, hogs, poultry, and poultry products; and 2 or 3 head of cattle are sold every year. Every 40 bushels of barley or 30 bushels of wheat sold from the farm carry with them phosphorus equivalent to 100 pounds of 16 per cent superphosphate.

It is true we have offset part of our losses in the purchase of bran, oil meal, and other concentrates which are rich in phosphorus. But the amount of phosphorus added to our farms through the purchase of feed will offset not more than one-fourth of the total loss incurred in the sale of milk, livestock products, and cash crops.

Plant-Food Removal

From the foregoing we can readily see that phosphorus is being lost from our farms at an alarming rate, but it is not so easy to figure the actual loss of potash, since milk and livestock products contain relatively small amounts of it. It's true that where we sell cash crops, that is, grain, hay, potatoes, tobacco, sugar beets, canning peas, cabbage, and other truck, we do lose large amounts of potash. In fact, if we figure the pounds of plant food actually sold and lost from the farm, we note that there is a tremendous loss of available potash from our farms. To illustrate this, I have tabulated a few crops to show the actual losses of phosphoric acid and potash.

TABLE 1. LOSSES OF PLANT FOOD IN SALE OF CASH CROPS

Crop	Acre yield	Pounds of P_2O_5 lost	Pounds of K_2O lost
Potatoes (tubers)	250 bushels	18 pounds	80 pounds
Sugar beets (roots)	15 tons	23 "	111 "
Tobacco (leaves)	1,500 pounds	5.9 "	82.6 "
Cabbage (heads)	12 tons	26 "	104 "
Alfalfa hay	4 "	43 "	178 "

But even on the dairy farm, where all crops grown are fed to livestock, we are safe in saying that at least 25 per cent of the potash removed from our cultivated fields never gets back to the land. In fact some authorities say that on many farms in this state where manure is carelessly handled, upwards of 40 per cent of this potash is lost in the feeding transaction and subsequent handling of the manure.

"Well," but you say, "I have plenty of total potassium in my soil. The soil chemists tell me that I've got from 30,000 to 40,000 pounds of elemental potassium per acre."

Yes, that's true, but you must remember that only a small percentage of this total amount is becoming available each year. Dr. Cyril G. Hopkins of Illinois used to tell us that less than ½ of 1 per cent of our total potassium was becoming available each year on the better soils. (Of course, Dr. Hopkins was never really much worried about an eventual potash shortage.) But now if we figure that we are losing 25 to 40 per cent of the available potash each year, and bear in mind the fact that this has been going on every year for the past 75 years, is it any wonder that some of even our best soil types in the state are responding to potash treatment?

Take the case of Will Renk & Sons at Sun Prairie, owners of 4 farms on one of our best soil types in this state (Carrington silt loam). The Renks are good farmers. They have limed every acre of tillable land of their farms. They manure liberally. They have grown legumes on an extensive scale. They have been outstanding livestock farmers—great sheep feeders. They have purchased thousands of tons of feed concentrates, and yet, surprising as it may seem, their soils are responding to the use of fertilizers rich in potash. In fact, we were

amazed at the response of barley to fertilizers on their farm in 1936. Tabulated below are the results of a demonstration conducted on barley in 1936.

The Renks purchased a large combination drill in 1937 and fertilized all of their barley—71 acres. They used an 0-20-10 at the rate of 200 pounds per acre. They left a few check strips here and there on some of the fields. We harvested comparable areas in order to determine the increase in yield. This has been a good year for grain, and the average yield on the fertilized barley (0-20-10 treatment) was 55 bushels per acre, as compared to 38½ bushels per acre on the check strips. Although rust did hit the fields and reduce the yields somewhat, rust hurt the unfertilized much more than it did the fertilized, due to difference in stage of maturity when the rust hit. Here's a 16½-bushel increase in yield on what has been considered land in a good state of fertility.

The more general use of fertilizers applied at the time of seeding down to alfalfa or hay and pasture mixture is being recommended. In the past Wisconsin farmers have been using considerable fertilizer on cash crops such as potatoes, sugar beets, cabbage, and canning peas. Many farmers have applied small amounts of fertilizer with an attachment on the corn planter, and have observed good results. We recommend these practices. The practice of hill dropping a small amount with an attachment on the corn planter has done much to improve the quality, increase the yield, and advance the maturity of our corn crops in Wisconsin.

But this small localized application of fertilizer to corn is not building up the fertility of our farms as a whole. More and more farmers are finding that the broadcasting of fertilizer at

Will Renk and Sons, Sun Prairie, Wisconsin, are convinced that fertilizers pay. The photo shows County Agent R. V. Hurley, Will Renk, and Professor E. J. Graul, eye witnesses to this amazing response to fertilizer treatment. Yields: 0-20-10 = 60.8 bu. per acre, check = 47.7 bu. per acre.

TABLE 2. WILL RENK & SONS FARM RESPONDS TO POTASH TREATMENT

Treatment	Yield per acre	Increase
0-20-0 (200 lb.)	40.4 bu.	4.1 bu.
0-20-10 (200 lb.)	46.6 "	10.3 "
Check	36.3 "	

the time of seeding is proving a profitable investment. Not only will the fertilizer increase the yields of small grains, but the residual benefits will carry over to the second and third year. Increases of a half ton in the yield of alfalfa or clover are common. Furthermore, the use of fertilizer at the time of seeding may make the difference between a good catch of seeding and failure. Tabulated below is a summary showing average yields of grain in plot demonstrations conducted during the past 5 years.

TABLE 3. RESULTS FROM FERTILIZER TREATMENT ON GRAIN

No. of farms	Average yield No fertilizer bushels	Average yield 0-20-0 bushels	Average yield 0-20-10 bushels
42	33.7	39.4	42.5
Average increase in yield.....	...	5.7	8.8

These demonstrations were conducted on farms scattered throughout southern and central Wisconsin on the heavier silt or clay loam types of soil. The average application of fertilizer amounted to about 200 pounds per acre. Two hundred pounds of 20 per cent superphosphate at present prices would cost about $2.50. At 60 cents a bushel, the increase for the superphosphate treatment is $3.42, leaving a net profit of 92 cents per acre over and above the cost of phosphate fertilizer. The phosphate-potash treatment cost an average of $3.90 per acre. The value of 8.8 bushels of grain at 60 cents a bushel is $5.28, leaving a net profit, over and above cost of fertilizer, of $1.38. We have charged the full cost of the fertilizer against the grain crop. This is hardly fair, for we know the residual carryover on seedings and other crops will show benefits for 2 or 3 years following.

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Thousands of acres of north-central Wisconsin silt loam soils are starving for potash, phosphates, and lime. This picture shows the response to 0-20-10 on the M. N. Rockman farm at Barron, Wisconsin. Check = 4.6 bu., 0-20-0 = 11.1 bu., 0-20-10 = 16.9 bu.

Minor Elements In Cotton Fertilizers

By R. P. Bledsoe
Georgia Experiment Station, Experiment, Georgia

THE study of fertilizers has been chiefly concerned with the needs of soils and crops for nitrogen, phosphorus, and potassium. Plant physiologists have known for more than 50 years that at least four other elements from the soil are needed for normal plant growth; namely, calcium, sulphur, magnesium, and iron. Recent research in plant physiology has shown that other elements are needed by at least some plants.

This newer group, called "trace" elements because of their effectiveness in minute amounts, consists of manganese, boron, copper, and possibly zinc. Experimenters have tried to prove that other elements are needed by plants, but proof of this is still lacking. Georgia soils contain such an abundance of iron that the probability that it will ever be needed in cotton fertilizer mixtures is very remote. Therefore, this element may be omitted from this discussion.

Higher Analysis Trend

Since the retail cost of plant food is much lower in the more concentrated fertilizers, economic considerations have brought about a trend toward the higher analysis mixtures. These can be and are prepared from the common standard materials, such as superphosphate (a mixture of mono-calcium phosphate and calcium sulphate), ammonium sulphate, nitrate of soda, cottonseed meal, tankage, etc., supplying an abundance of calcium and sulphur and small quantities of magnesium.

The more concentrated materials now available for even higher and more economic plant-food analyses include ammonium nitrate, ammonium phosphate, potassium nitrate, urea, etc., which may contain no more than traces of calcium, magnesium, and sulphur. Experiments in Georgia, North Carolina, and Virginia in cooperation with the U. S. Department of Agriculture showed that acid-forming, concentrated fertilizers prepared from the latter group without additional materials were not as efficient as single-strength fertilizers for cotton on most cotton soils.

Since the major plant-food elements—that is, phosphorus, nitrogen, and potash—can be sold much cheaper in the concentrated form than any other way, it has become a matter of enormous economic importance to determine why concentrated fertilizers gave poorer results with cotton than single-strength fertilizers. Consideration of the problem seemed to indicate that the difference was due in part at least to the equivalent acidity of the sources of nitrogen. However, the content of the minor plant-food elements appeared to be a possible factor calling for further investigation. Therefore a series of experiments was started to determine the value of the minor elements, calcium, sulphur, and magnesium, and the trace elements manganese, boron, copper, and zinc in

cotton fertilizers. The results of these experiments showed that good results can be obtained from concentrated fertilizers provided enough limestone is added to the mixture to correct the equivalent acidity. The results obtained from the addition of the minor plant-food elements will be discussed in this paper.

It should be noted that it is impossible to plan a fertilizer experiment so as to eliminate all secondary effects. The chemical reactions in the soil are very complex, and the beneficial effects produced by adding an element to the soil do not in any way mean that that element is needed as a plant food. The reaction of the fertilizer with the soil may produce a condition beneficial to plant growth. For example calcium carbonate is commonly added to soils, not to supply calcium but to raise the pH of the soil. Nitrate of soda on some soils gives better results than other sources of nitrogen, apparently due to the liberation of potash.

In the following experiments some of the benefits noted from the addition of minor elements to the soil may have been due to such secondary effects rather than to the use of the element as a plant food. Also, the fertilizer used may have contained minute quantities of zinc, boron, copper, or manganese which could not be detected by ordinary analysis.

Calcium Proves Beneficial

The experiment to test the value of calcium sulphate in cotton fertilizers has been run for 3 years at 10 locations. The basic fertilizer was made from mono-calcium phosphate, nitrate of soda, and potassium chloride. Such a fertilizer would contain some calcium but not as much as is found in ordinary fertilizers, and no sulphur.

When 50 pounds of calcium sulphate were added to the above fertilizers, the yield of cotton was increased 81 pounds of seed cotton per acre. The increase was five times the experimental error, so that the results were highly significant.

When potassium sulphate was used in the above fertilizer in place of potassium chloride, the yield of cotton was increased 20 pounds. This increase was too small to be very significant.

The above experiment seems to indicate that cotton fertilizers should contain a fairly large amount of calcium and possibly some sulphur. However, a possible explanation of the increase obtained in this experiment is that the sulphate content of the fertilizers increased the availability of the magnesium in the soil and therefore increased yields.

In other experiments calcium carbonate was added to acid concentrated fertilizer. Most of the increases obtained from the limestone were undoubtedly due to correcting the acidity of the fertilizer, but some may have been due to the value of the calcium as a plant food.

Results From Magnesium

Results from three experiments with magnesium are available. In the first of these experiments located at the station, 50 pounds of magnesium sulphate were added to a concentrated fertilizer made from ammo-phos, urea, and potassium phosphate. A 7-year average of the results shows that the magnesium sulphate increased the yield of cotton 172 pounds.

In another experiment 50 pounds of magnesium sulphate were applied as a top-dressing on cotton fertilized by the farmer. The farmer's fertilizer may have contained magnesium in some cases. The experiment was run at seven locations over a period of two years. At one location the magnesium produced a decrease both years. At the other six locations the magnesium produced an increase of 41 pounds of seed cotton per acre.

In the third experiment calcic limestone was compared with dolomitic

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A typical example of lodging in a field of winter wheat.

High Potash Fertilizers For Fall Use

By G. J. Callister
American Potash Institute, Inc., Washington, D. C.

THE practice of applying phosphate and potash in the fall is increasing. Such fertilizers as the 0-12-15, 0-12-10, and variations of these analyses—no nitrogen and relatively high percentages of phosphate and potash—are on the market, offering profitable opportunities for use in the fall. Three such possibilities are briefly noted here, namely, on fall wheat, alfalfa and other legume hay crops, and orchard cover crops.

Fall Wheat: As farmers have observed, fertilizers applied to fall wheat often favorably influence the catch of clover and grasses following the wheat. In fact, the residual effect on succeeding crops is often as important as the effect on the wheat to which the fertilizer is applied. Too, as pointed out by the Advisory Fertilizer Board of Ontario, "The use of the proper type of fertilizer offers substantial insurance against winter-killing of fall wheat and clovers."

One of the risks of growing winter wheat is winter-killing, which frequently causes heavy losses. Winter wheat should be sown sufficiently early in the fall to insure a good root development and a top dense enough to hold the snow which serves as protection.

Another risk is the lodging of the crop. This may be due to different causes, but prominent among them is a low mineral level in the soil, resulting in weak straw.

The third risk is the ever-present rust for which there seems to be no preventive other than the breeding of good rust-resistant strains and hastening the maturity of the crop.

Such risks may, however, be reduced by the use of the right fertilizers. High phosphate and high potash will tend to hasten maturity, strengthen the straw, and increase disease resistance. According to Van Slyke, a 40-bushel crop of wheat and

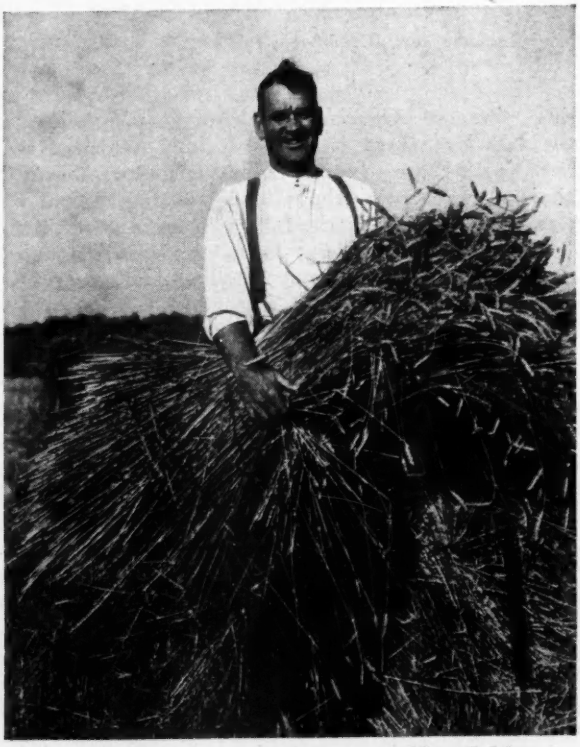
2 tons of clover hay remove 113.2 pounds of potash from the soil. Whether there is enough available potash in the soil is, therefore, an important question. The condition of the crop should be studied. Lodging of the straw, yellowing of the tip of the leaf which later extends along the leaf margin, poorly filled kernels, meager growth, and poor stooling in wheat are evidences that a higher potash fertilizer should be used.

No one analysis will suit all conditions. Whether the land is heavy, whether it has been well manured, or whether the winter wheat follows clover has to be taken into consideration. It is necessary to add nitrogen to phosphates and potash under certain conditions, especially on lighter soils and where no manure has been used.

On the lighter soils the 0-12-10, 2-12-10, 2-8-10, 0-10-10, and 0-12-15, or other high potash analyses should be used. On heavier soils the 2-12-6 or 0-12-6 may be suitable. The rate of application varies, ranging from 200-500 pounds per acre in different wheat-growing sections.

The important thing to remember is that enough fertilizer should be applied to the wheat not only to meet the requirements of the wheat but to benefit the clover following. The average amount of fertilizer applied to wheat in many cases barely takes care of the amounts of phosphate and potash removed by the wheat crop. The clover is therefore on a marginal basis right from the start. If symptoms of starvation are shown by the leaves of the legume, additional fertilizer should be applied to the legume hay.

Alfalfa and Other Legumes: Legumes demand plenty of potash if they are to make a good growth. Minerals can be profitably applied early in the fall as well as early in the spring. On heavy soils the 0-12-6 and on lighter soils the 0-12-10, 0-12-15, or other high phosphate and potash analyses can be profitably used. At least 250 pounds per acre are recommended, and larger amounts should be used if the mineral content of the soil is low.



Straw like this can carry a heavy crop without lodging.

With normal methods of fertilization, it is difficult to provide enough of the minerals, lime, phosphate, and potash, for a longer period than 2 or 3 years. Experimental work and experience of practical alfalfa growers, for example, indicate definitely that by making larger initial applications of the min-

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Growing Herbs In The Family Garden

By E. N. Bressman
United States Department of Agriculture

HERBS are plants that are utilized for culinary and medicinal purposes. They are among our oldest cultivated plants, yet little of a scientific nature is known of the best methods of production and use. Doubtless, the greatest use for herbs grown in the ordinary farm garden would be culinary. At any rate a few of these interesting plants will delight the eye and add "spice" to home cooking.

Many growers have had in the past, and there is no reason why they should not have in the future, a keen interest in medicinal herbs; however, this discussion will be confined chiefly to those herbs that can be used in the farm kitchen. The plants should form a part of the practical rather than the aesthetic type of garden. On many farms, and rightfully, the garden does not remain on one spot of ground year after year. Still, as a rule, there is a patch of ground, possibly close to the grapes or berries, where asparagus, dill, and similar plants are grown. This might be the place to grow a few of the practical culinary herbal plants.

Numerous Varieties

There is no set number of herbs that should be grown in the farm garden. The number of different kinds runs into the hundreds. Some herb enthusiasts feel that it is necessary to grow some half-hundred different sorts in order to qualify as an herbalist. The ordinary farm garden, however, would include anywhere from 6 to 20 different species of herbal plants.

Much detail has been written about just the right amount of sun, shade, moisture, and soil ingredients for herbs. It is true that there are optimum conditions for each and every species. For example, it is claimed that sweet marjoram prefers sandy soil and sweet basil a heavier, richer type. But it is a good guess that farm garden conditions are satisfactory for most herbs. In many gardens the lack of moisture and facilities for supplying moisture daily will be limiting factors. There is no need for going to a lot of trouble making compost, mixing sand and loam, etc. Such procedures look good on paper, but do not fit in with either the farmer's or his wife's busy day.

Keep Under Control

Right here, it might be desirable to point out the possibilities of some herbs becoming weed pests. This is true of various parslies, fennels, and similar types. Under certain climatic conditions these herbs produce large amounts of seeds which might be scattered about the farm. This, however, is a chance one takes in growing any plant outside of the ordinary group of field crops. Ordinary care is the herbalist's best safeguard.

Possibly dill is the most useful herb that the farm garden might include. Its widespread use in the making of pickles puts it in constant demand.

Dill is usually started in flats from seed, but may be planted directly in drill rows in the garden. The seed germinates well, and the plants grow with little difficulty. At harvest the seed heads are stored in bunches for ready use when pickles are made. Their chief function, of course, is to add flavor.

One of the most common herbal plants is mint. There are numerous kinds of mint, but the "common, everyday, garden variety" is spearmint. Its principal use is for flavoring cold drinks, such as iced tea. Another common use of course, is in the making of mint jelly. Mint is an easily grown plant. It is invariably propagated by runners. Ordinarily the plant produces great quantities of runners, and it is never difficult to get a supply for propagating. In some areas it is a commercial crop, and fairly large acreages are to be found on muck soil in the Pacific Northwest, southern Michigan, and northern Indiana. In addition to spearmint there are several other well-known members of the mint family, all characterized by square stems. These include thyme, rosemary, lavender, marjoram, and many others.

A few plants of basil, a small annual that is used primarily for seasoning, would be of value in any herb garden. These are easily started in the field and will grow with ordinary care. The plants are usually harvested when they are in bloom and then dried for use, in the same way as dill and similar seasoning plants.

Sage is one of the most common seasonings used in the kitchen. There are a large number of species of this plant, but the common sage is the one used for culinary purposes. It is propagated either from seed or cuttings. As is well known, the leaves are harvested, dried, and crushed for seasoning purposes. Tarragon is another herbal member of the sage (Artemesia) family.

An herb plant that requires conditions a little different from those usually found in the farm garden is water cress. As its name implies, it requires moist conditions. This plant is more sensitive to lime requirements than most and needs a large amount of lime for satisfactory growth. It is used primarily in salads and for garnishing meats. Often it is kept over winter in a handy spring.

Parsley is a common herb that needs no introduction to farm families. What is of interest, however, is the large number of varieties of this well-known herb. All of them are rather easily grown from seed. Anyone not familiar with the coarser types of parsley that are used in soups would find a pleasant surprise in their aromatic flavor. Of course, there are a large number of herbal plants, both common and rare, that belong to the parsley family. Some that should be included in the farm herb garden are coriander, anise, fennel, and chevril. Many prefer chevril to parsley and use it as a substitute for the latter.

Borage is the family name of several valuable herbs. The best-known culinary herb in this group is called borage. It is an annual that makes a delightful addition to salad because of its cucumber scent.

Unusual Types of Herbs

There is a group of plants, ordinarily classed as vegetables, that may be included with the herbs. This group includes celery, chives, artichokes, garlic, and cucumbers. Celery is sometimes used primarily for its flavor, and the seed may be ground to make what is called "celery salt." Chives and garlic, as is well known, are closely related to the onion, and impart to soups and salads a mild onion flavor. They are propagated through the division of the clumps of small bulbs.

There are many unusual plants that are grown for herbs. Some of these are usually considered weeds and other

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Fertilize to Control Cotton-belt Erosion

By G. A. Hale
Forrest City, Arkansas

EROSION control is largely a problem in the proper use of row-crop land, and the rapid revegetation of all land not in clean-tilled crops. Research in methods of preventing excessive run-off and soil losses shows that a luxuriant growth of vegetation offers ideal protection from erosion. A thick cover of plants on fertile land is a natural condition. Eroded land is usually poor land and sparse vegetation is generally found on washed fields.

Choosing and using the quickest and most economical methods of establishing an erosion-resisting plant cover on washed land comprise one of the big problems of the soil conservationist. Surveys show that most of the topsoil has been eroded from millions of acres now used for cultivated crops. With this topsoil has gone practically all the original organic matter and available nutrients for plant growth. The only way to restore these acres to where they will produce crops economically within a reasonable length of time, is by the use of commercial fertilizers. By fertilizing erosion-resisting crops, accelerated erosion can often be stopped during the first year after planting.

Southeastern farmers have demonstrated that profitable crops can be grown, with the aid of commercial fertilizers, on eroded land. It is true that they have used chemicals as a sort of stimulant for erosion-sick soils

A fall fertilized and seeded meadow waterway with a good vegetative cover in mid-winter.

without adopting soil conservation practices to anything like the extent needed to conserve their valuable topsoil, and much of it has been impoverished beyond repair for growing field crops.

Farmers in the eroded hill sections west of the "fertilizer belt," especially in Arkansas and Louisiana, are overlooking a very good practice to not only help control erosion but also increase acre yields by not using commercial fertilizer along with more erosion-resisting crops. Thousands of acres of comparatively new farm lands in the Southwest are rapidly losing fertility by erosion and excessive cropping, because farmers are not putting back any of the minerals removed by these destructive forces.

Many of the fertilizer experiments to find out what kind to use for most profit in the South have been conducted on the less severely eroded fields and with erosive crops such as corn and cotton. Most of these trials and experiences of farmers indicate that a complete fertilizer containing nitrogen, phosphate, and potash is the most profitable for cotton on hill land. Since cotton, of all common field crops, will usually return the greatest profit per dollar invested for fertilizer, it is a frequent practice to use all the fertilizer in a crop rotation under it.

Legumes Utilize Residue

Where cotton is well fertilized, winter legume cover crops like vetch, crimson clover, and Austrian peas will make satisfactory growth by feeding on the fertilizer residue when planted in the cotton middles. Putting the fertilizer under cotton and following it with legumes is the most practical way to fertilize vetch, lespedeza, and other legumes. It is a waste of seed and labor to plant winter cover crops on badly washed land without fertilizing the preceding crop or applying fertilizer directly to the winter crop.

All legumes are heavy feeders on phosphates, potash, and lime. From 200 to 400 pounds of superphosphate or basic slag per acre are often necessary to make a luxuriant growth of vetch or other legumes for adequate erosion control, when they are well inoculated so they can get required nitrogen from the air. Potash needs of legumes are more variable than phosphate requirements. As a rule, where cotton rusts and on sandy land, applications of from 25 to 50 pounds of muriate of potash will pay under legumes, but as already stated this fertilizer can usually be applied to best advantage to the cotton preceding the legume crop. The lime requirements of southern legume crops, except red clover, sweet clover, and alfalfa, can often be satisfied by the calcium contained in other basic materials, such as superphosphate, when these are used at recommended rates.

Feed the Grasses

Members of the grass family, such as oats, wheat, sorghum, Sudan, Bermuda, and other grasses so valuable in erosion control, are heavy feeders on nitrate of soda, sulphate of ammonia, manure, or other applied nitrogen carriers. Nitrogen is usually the first plant food to become a limiting factor in plant growth on eroded fields. "Grow your nitrogen by planting legumes," has been advocated for many years and is a very commendable recommendation. The sooner the inadequacy of the procedure as now practiced is admitted, the sooner cotton farmers will be induced to arrest the rapid loss of soil nitrogen by supplementing the insufficient amount now gathered by well-inoculated legumes with adequate amounts of commercial nitrogen.

Where grains and grasses are grown in a rotation with cash crops, fertilized with a complete fertilizer, an application of from 100 to 200 pounds of nitrogen fertilizer applied as a top-dressing is usually sufficient for good acre yields. On some fields a nitrogen-potash mixture may be used profitably on grain.

Newly sodded or seeded pastures on

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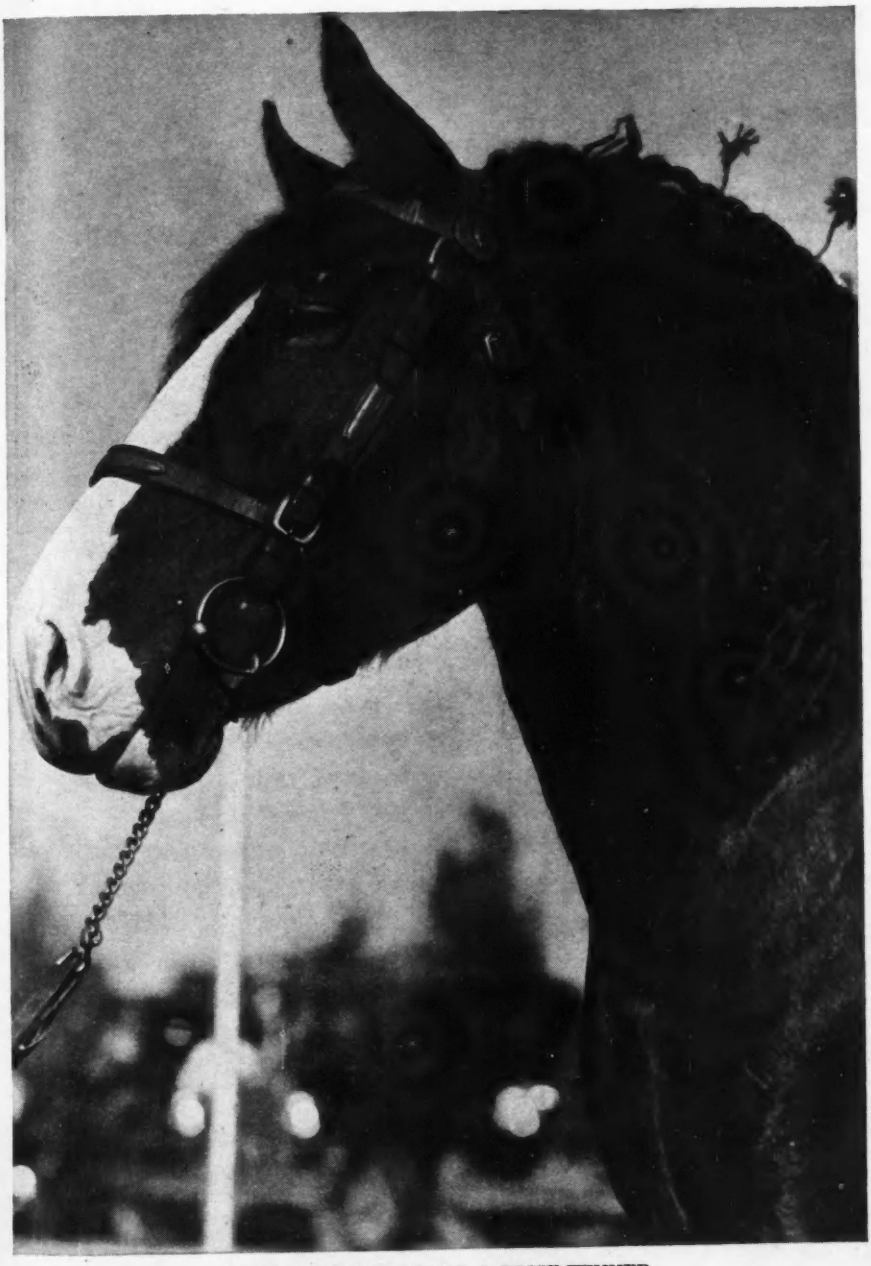
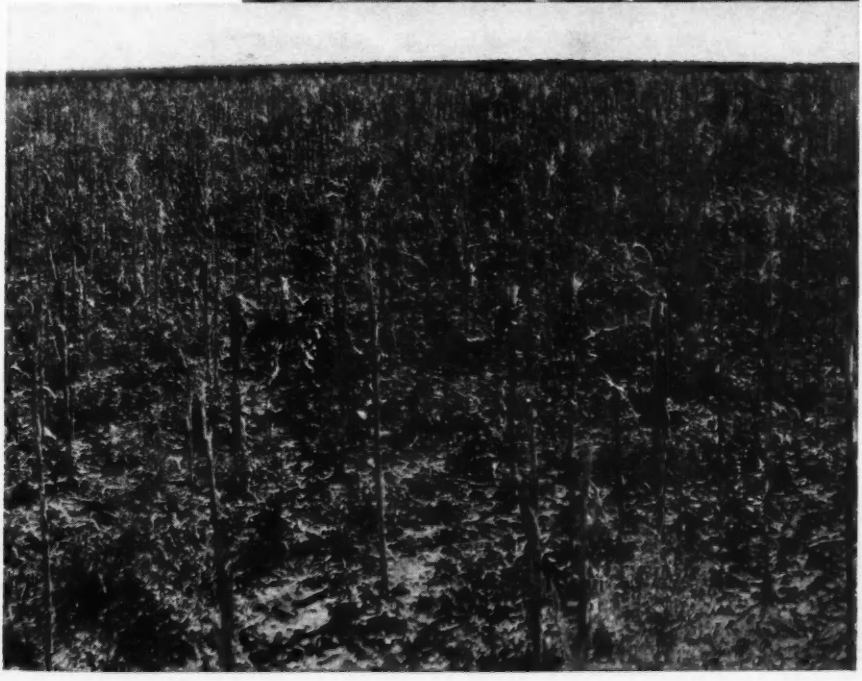
PICTORIAL



THE CONFIDENT AIR OF A PRIZE-WINNER.

PLANS FULFILLED.

HOPES
THWARTED.



Left: A pony express serving agriculture.

Below: State fairs engender stiff necks.

The Editors Talk

Beyond Line Fences

Of the hundreds of conventions and other types of meetings held during the summer, notable as to purpose was the joint meeting of Iowa Farmers and the Agricultural Committee of the National Association of Manufacturers held at Iowa State College, June 10-11. The event, unique in agricultural-industrial relationships, was sponsored by officials of the college and brought together a group of representative farmers and executives of several large companies for the purpose of giving manufacturers at first hand a better understanding of the agricultural viewpoint and situation.

Forewarned that the manufacturers had no "farm plan" and did not expect to develop one, the farmers found the committee interested listeners and participants in discussions on subjects ranging from farm tenancy, soil erosion and conservation, and foreign markets for farm produce, to price parity and price determination, farm capitalization and credit, and stabilization of farm income. "Business men now know that agriculture and industry—as the two great producers of the national wealth—have a great many problems in common," Warren W. Shoemaker, Vice President and General Sales Manager of Armour & Company, had told the group at the opening of the conference. "Our interests lie along the same lines. When agriculture is prosperous and happy, statistics show that industry is enjoying its best years. When agriculture is depressed and sick, so is industry. Together, agriculture and industry account for one-half of the total gainfully employed in the United States. . . . Cooperation between industry and agriculture is necessary to our national welfare."

As the discussions proceeded, the farmers evidenced a great interest in the problems of industry, many of which they found to parallel their own problems. This interest culminated at the end of the conference in a proposal by Fred Nelson, Nevada County farmer, on behalf of his fellow farmers that a new attitude toward industry be adopted. "If this committee of manufacturers is going to spread a better understanding of farmers among the business men of the nation, then I think we farmers should spread a better understanding of industry among our fellow farmers," he said. "This educational program must be carried on from both ends. Personally, I am greatly impressed by the sincerity of approach and the interest which industry is showing in the farmer through this committee. I have gained a new impression of business men in this conference and I think we farmers should let the other farmers know what we have learned here."

In closing the meeting, Dr. Charles E. Friley, President of Iowa State College, expressed the opinion that "there is no problem in the world that cannot be solved in the light of a better understanding. I think the significant accomplishment of this meeting is the better understanding that has resulted between industry and agriculture from the candid, sincere discussions that have taken place in such a spirit of mutual helpfulness and respect."

It is always good to go "beyond line fences." There is inspiration in finding common ground. Misunderstanding has no place in progress, and it is to

be hoped that conferences of similar nature will be held in the future to further the realization of the interdependence of agriculture and industry.

Potash and Frost

Among the many functions which potash fulfills in the plant, an important one is protection against frost injury. It is not possible, of course, to guarantee that a plant well supplied with potash will not suffer damage by frost or cold weather. There is a limit to the protective action in this respect. However, numerous observations and experiments have indicated that plants well supplied with potash can withstand a lower temperature without injury than can plants lacking potash. The critical one or two degrees extra coldness that potash-fed plants can withstand may mean the difference between a successful crop and a total failure.

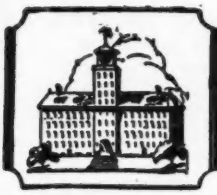
The way in which potash acts in reducing frost injury is not fully understood. Part of it is supposed to be due to the lowering of the freezing point of the cell sap, due to the increased salt concentration provided by the potash fertilization. This action is comparable to the effect produced by spreading table salt on an icy pavement to prevent freezing. It would appear very reasonable to expect that at least part of the protective action of potash is due to this effect of lowering the freezing point. Many investigators, however, have believed that this is not the whole story and J. Stoklasa and B. Havlinove, Czecho-Slovakia, recently summarized 50 years of observation of plants growing in the field and greenhouse with copious and deficient supplies of potash. The summary of this work appearing in the Experiment Station Record for January, 1937, confirms that when soils are deficient in available potassium and phosphorus, root dying and freezing injury are much more pronounced with favorable weather. They found that barley, wheat, rye, sugar beets, and potatoes grown in soils fertilized with potassium, phosphorus, and sodium were not so readily frozen as when these crops were grown in soils deficient in these elements. The authors believe that when these three elements are lacking the plant cannot breathe or carry on its respiratory functions normally. This results in a reduced physiological combustion which probably reduces the amount of heat generated in the plant and therefore permits it to freeze.

In any case, the proper use of potash provides an added factor of safety in permitting the plant to withstand unfavorable weather conditions. This, added to its other important functions, makes potash cheap insurance.

Soil Testing Marches On

The practice of testing the fertility of soils by means of rapid chemical methods is becoming more general. Service laboratories for soil testing on a large scale are being provided by Agricultural Experiment Stations. Many agricultural teachers and county agents are making extensive use of the tests. Private laboratories are being set up for soil testing on a commercial basis. A number of fertilizer companies have provided central laboratories, and many fertilizer salesmen are making use of the tests in the field.

Further indication of the importance being accorded this phase of soil management is seen in the amount of time devoted to it at 94th Meeting of American Chemical Society recently held at Rochester, N. Y. One entire afternoon of the program of the Division of Fertilizer Chemistry was given over to papers and discussions by scientists doing research on the subject. It is in such meetings, combined with the increasing practical application of the various methods, that any current difficulties and criticisms will be straightened out.



REVIEWS

This section contains a short review of some of the msot practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

North Carolina Experiment Station Bulletin 308, entitled "Influence of 'Rust' on Quality and Yield of Cotton and the Relation of Potash Applications to Control," contains much instructive information resulting from studies of the effect on quality, yield, and rust damage of cotton from applications of potash salts in areas of North Carolina where cotton and peanuts are grown in rotation. J. H. Moore and W. H. Rankin, the authors, think that the type of cotton rust injury observed in this section is usually associated with a shorter staple length, a weaker fiber, and a smaller yield. The common fertilizer and cropping practices do not correct the condition. Controlled tests covering a period of 2 years where additional applications of potash ranging from 25 to 50 pounds per acre were used on fields subject to rust produced significantly larger yields of cotton, heavier seed, heavier bolls, a higher lint index, a better grade, a longer staple length, a stronger fiber, and a lower percentage of thin-walled fibers than the check plots which did not receive additional potash after planting. Where low percentages of potash are used in fertilizer mixtures applied to cotton at planting time in the peanut section of the State, especially in cases where rust has caused considerable loss in yield and damage to quality of the fiber, the publication suggests that a supplemental application of potash be made soon after chopping. Judging from field observation and interviews with a number of farmers whose cotton was severely damaged in recent years, it is generally believed that this damage is more prevalent on farms that have been limed heavily, have poor drainage, or have had a number of legume crops removed. The authors conclude that while additional applications of potash appear to offer the most practical method of decreasing rust damage, further studies of the soil conditions associated with rust damage in this area will perhaps reveal other causes and supplementary means of control.

From Mississippi, L. E. Miles, of the agricultural experiment station, stresses the value of potash to control wilt on cotton in Technical Bulletin 23, entitled "Effect of Potash Fertilizers on Cotton Wilt." The experiments reported extended from 1928 through 1934, some for shorter periods and others practically throughout the entire time. From the results, it is concluded that fairly high potash applications in proper combination nitrogen and phosphorus-containing salts have given definitely beneficial results in control of cotton wilt on the soils of south Mississippi, of north-central Mississippi, and of the border area of the Yazoo-Mississippi Delta. Under decidedly adverse conditions and with an extremely susceptible variety of cotton on soil severely infested with the wilt organism, potash, even when combined in adequate amounts with other necessary fertilizer elements, cannot be depended upon for wilt control. On severely infested soils a

variety of cotton at least relatively resistant to wilt should be used as well. The author concludes that the best solution for cotton wilt now available would seem to be the use of a suitably adapted wilt-resistant variety of cotton together with the judicious use of fertilizer containing potash in adequate amounts and in proper balance with other necessary fertilizer elements.

Following an extensive investigation in the development of improved methods for the commercial production of fertilizer materials, U. S. Department of Agriculture Technical Bulletin 543, entitled "Blast Furnace Processes for the Production of Phosphatic and Potassic Fertilizer Materials," describes the technical feasibility and commercial practicability of producing phosphatic and potassic fertilizer materials by the blast-furnace smelting of phosphate rock and potash-bearing silicates. The authors conclude from these preliminary results that savings may be expected by the simultaneous production of phosphorus and potash in a single furnace over their production in separate furnaces. This process would enable the producer to ship potassium phosphates, materials containing from 85 to 100 per cent plant food, which can be applied directly to the soil. According to results obtained from the experimental blast furnace plant described in this bulletin, the authors point out that, while the blast furnace processes in the production of phosphatic and potassic fertilizer materials appear to have commercial possibilities, further investigation on the pilot-plant scale must be conducted before final conclusions can be drawn.

"Fertilizing Illinois Wheat," Agr. Ext. Serv., Urbana, Ill., Mimeo., May 1937, L. B. Miller and F. C. Bauer.

"Speed and Accuracy in Determination of Total Nitrogen," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 261, May 1937, A. E. Murneek and P. H. Heinze.

"Manure, a Profitable By-product," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 198, Feb. 1937, Jay L. Haddock.

"Chemical Nitrogen—A Survey of Processes, Organization, and International Trade, Stressing Factors Essential to Tariff Consideration," U. S. Tariff Commission, Washington, D. C., Report No. 114, Second Series.

Soils

Realizing the great importance of curbing the effects of soil erosion so prevalent on a majority of our soils in this country, there frequently appear under this department brief citations from the many valuable publications devoted to this subject. We list in the following a few touching the high points of soil conservation as contained in the more recent publications from experiment stations, extension services, and the U. S. Department of Agriculture.

"Soil Erosion in Michigan Orchards," Circular Bulletin 162 of the Michigan Agricultural Experiment Station, by N. L. Partridge, brings together some of the more pertinent observation records and discusses the practicability of various methods dealing with erosion problems in fruit orchards. The use of annual cover crops is pointed out to be helpful in maintaining control. Complete permanent sod cover is the cheapest effective method for controlling erosion on moderately steep slopes when the kind of fruit plant set will tolerate that type of cover on the particular soil. When it is necessary to cultivate a portion of the orchard, protective strips of sod may be kept in each tree row or the cultivation may be confined to the space between alternate pairs of tree rows, which will usually give sufficient protection on gently rolling sites. The first and most important step in erosion control is the setting of the trees on sites where excessive erosion has not already removed the surface soil, and then the simpler cheaper methods of control will be sufficient to retain the productivity of the soil in nearly every instance.

An array of fundamental principles relating to soil conservation is outlined

for the 4-H clubs in Michigan Club Bulletin No. 33, "Soil Conservation Program," by James A. Porter. The information given in this interesting bulletin is offered mainly for Michigan farm youths so that they may study for themselves the numerous erosion problems. A considerable portion of the subject matter pertains to farm mapping projects.

"Conserving Soil by Strip Cropping," by W. R. Tascher and Marion W. Clark, is the title of the Missouri Agricultural Extension Service Circular 368. Strip cropping is a simple, economical, and effective soil conservation method that may be used with crop rotation and soil treatments to check erosion on many Missouri farms. Among the subjects discussed are: rotation strip cropping, procedure for laying out fields for rotation strip cropping, field stripping, buffer stripping, and suggestions for laying out buffer strips and how they may be used preparatory to terracing.

In "Safeguard the Gains of Soil Conservation," North Carolina Extension Circular 216, the extension service reports that during the past few years the people in North Carolina have made great gains in combating soil erosion. A warning is given, however, that erosion once under control will not remain so without continued care. Terraces once built will eventually cease to function if not properly maintained; woodlands must be protected from fire and grazing; and a good rotation, once established, must be continued indefinitely. To safeguard these gains made at the cost of much time, thought, labor, and money, should be the concern of every land-owner who has launched upon a program of soil conservation. Among the practices advocated are to follow the farming and forestry practices recommended by county agents and to repair promptly all damage that has been done by erosion.

U. S. Department of Agriculture Farmer's Bulletin 1776, "Strip Cropping for Soil Conservation," by Walter V. Kell and Grover F. Brown, gives a broad description of how this practice has been successfully employed in many localities for years as one of the practical measures to conserve soils. Detailed explanations of the three types, contour, field, and wind strip cropping, are outlined in this bulletin. The information presented is the result of a careful study of this means of erosion control throughout the United States and includes the latest developments in this field of work.

Regional Information Series WR-Leaflet No. 103, "Conservation of the Western Range," gives an outline of the 1937 program for western range land. There are numerous factors that interfere periodically with the average range operator's plan. Weather records show an average of 1 to 4 years of drought out of every 10 years. These weather changes bring wide variations in the amount of forage produced on the range, and these fluctuations in forage production make up one of the principal problems of stockmen. Practices which aid water conservation on range land can increase appreciably the amount of forage produced. Among these are: developing springs and seeps, constructing earthen pits and reservoirs, digging or drilling wells, contouring, and water spreading.

Information of much value to many Virginia farmers is given in Virginia Truck Experiment Station Bulletin 94, entitled "Truck Crop Investigations," by J. B. Hester and Florence A. Shelton. The investigations reported deal with soil organic matter of coastal plain soils. There have arisen many conflicting problems as a result of the cropping systems practiced in this, one of the oldest farming regions of the Middle Atlantic States. Such practices have failed to provide for soil fertility maintenance. These soils re-

spond to most soil amendments, and owing to their low organic matter content, they also respond to the turning under of green manure and cover crops. Because the high state of fertility of the soil must be kept up for successful production of vegetable crops, it is evident that the well-drained soil having the highest organic matter produces the best crops. The use of soil improvement crops appears, therefore, to be an economical method of maintaining soil fertility.

"The Relation of Nitrogen and Soil Moisture to Growth and Fruitfulness of Apple Trees Under Different Systems of Soil Management," Agr. Exp. Sta., Lafayette, Ind., Bul. 414, Nov. 1936, Clarence E. Baker.

"Electric Soil Heating for Hotbeds," Agr. Exp. Sta., Lafayette, Ind., Cir. 226, Nov. 1936, T. E. Hienton and J. H. MacGillivray.

"The Reaction of Greenhouse Plants to Gas in the Atmosphere and Soil," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 285, May 1937, Paul R. Krone.

"The Utilization of Wabash Clay (Gumbo) Soils in Crop Production," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 254, May 1937, B. M. King.

"Behavior of Legume Bacteria (Rhizobium) in Relation to Exchangeable Calcium and Hydrogen Ion Concentration of the Colloidal Fraction of the Soil," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 256, May 1937, Thomas M. McCalla.

"Irrigation Experiments with the Early Grano Onion," Agr. Exp. Sta., State College, N. Mex., Bul. 245, Feb. 1937, A. S. Curry.

"Soil Survey of Winston County, Alabama," U. S. D. A., Washington, D. C., Series 1932, No. 12, M. E. Swann, M. E. Stevens, M. C. Croft, and W. E. Tharp.

"Soil Survey of Cass County, Texas," U. S. D. A., Washington, D. C., Series 1933, No. 3, M. W. Beck, Howard William Higbee, and R. M. Marshall.

"Soil Survey (Reconnaissance) of Vermont," U. S. D. A., Washington, D. C., Series 1930, No. 43, W. J. Latimer, S. O. Perkins, F. R. Lesh, L. R. Smith, and K. V. Goodman.

Crops

We have received a large number of most excellent and very instructive publications which we classify under this heading.

Many celery growers will profit from the information contained in Florida Agricultural Experiment Station Bulletin 307, "Cracked Stem of Celery Caused by a Boron Deficiency in the Soil," by E. R. Purvis and R. W. Ruprecht. Cracked stem, the disease which occurs more frequently on light, sandy soils and usually appears first on high, dry spots of the field, often causes a loss of as much as 50 per cent of the celery crop. This disturbance is not restricted to the poorer soils, but frequently occurs on even the better soils. The text explains that cracked stem of celery has become quite common in practically every celery-growing area in the eastern part of the United States and Canada, which indicates that the celery plant is a gross boron feeder. The depletion of the element from such a wide variety of soils can hardly be explained otherwise, the author states. Once the deficiency has been established, the use of usual fertilizer mixtures, even those containing crude materials, will hardly supply enough of this element to produce normal plant growth. The disturbance is prevented by the application of commercial borax at the rate of 10 pounds per acre applied to the soil in close proximity to the base of the plant, approximately two weeks after the plants are set in the field. The authors believe the simplest and best way to supply such small amounts of borax is in solution, and good results have been obtained by using spray machines. An application of borax not only prevents the appearance of cracked stem, but it also produces a decided increase in yield of marketable celery on soils deficient in boron. More than 10 pounds per acre are not advised because of the danger of toxic conditions developing.

Circular 227, Indiana Agricultural Experiment Station, entitled "Mint Culture in Northern Indiana," by N. Kent Ellis, reveals many of the secrets of success in growing mint. Owing to the very favorable soil and climate for mint in northern Indiana and the southern half of Michigan, the world's production is now centered in this

area. Mint can be grown on a wide range of soils and does well on alkaline soils that are unadapted for growing onions, potatoes, and other vegetables requiring a slightly to medium acid soil. The soil should be in good tilth and as free of weeds as possible. If the crop is planted early on new soil, 200 to 400 pounds of 2-8-16 fertilizer per acre should be used. This may be applied either broadcast or with a combination grain and fertilizer drill before the plants or roots are set, or applied in bands on either side of the row by means of a fertilizer attachment on a cultivator, after the rows are established. If the plants are set late, from 200 to 400 pounds of 0-8-24 fertilizer would prove more economical, the author explains. On established plantations an early spring application of 250 to 500 pounds of 2-8-16 fertilizer may be applied with a disk drill or broadcast and harrowed in. For fall fertilizer applications, the 0-8-24 fertilizer should be used. On soils which produce too heavy growth of mint hay, it has been found that 200 to 300 pounds of 0-20-20 give better results. Other information pertaining to mint production discussed in this circular includes descriptions of mint varieties, methods of propagation, cultivation, harvesting, distillation, and the control of insects and diseases.

"Report of the Director for the Year Ending June 30, 1936," Agr. Exp. Sta., Storrs, Conn., Bul. 214, Jan. 1937, William L. Slate, Director.

"Report of the Director for the Year Ending October 31, 1936," Agr. Exp. Sta., New Haven, Conn., Bul. 393, Feb. 1937, William L. Slate, Director.

"Forest Lysimeter Studies Under Red Pine," Agr. Exp. Sta., New Haven, Conn., Bul. 394, June 1937, Herbert A. Lunt.

"1936 Report Cooperative Extension Work in Agriculture and Home Economics," Agr. Ext. Serv., Gainesville, Fla., Wilmon Newell, Director.

"Herbaceous Perennials for Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 89, May 1937, J. V. Watkins.

"Experiments for the Control of Phoma Rot of Tomatoes," Agr. Exp. Sta., Gainesville, Fla., Bul. 308, Mar. 1937, W. B. Tisdale and Stacy O. Hawkins.

"Papaya Culture," Agr. Exp. Sta., Gainesville, Fla., Pr. Bul. 502, June 1937, H. S. Wolfe.

"Collecting Deer Tongue Leaves," Agr. Exp. Sta., Gainesville, Fla., Pr. Bul. 501, June 1937, J. Francis Cooper.

"Forty-ninth Annual Report of the Director for the Year Ending June 30, 1936," Agr. Exp. Sta., Lafayette, Ind., John H. Skinner, Director.

"Report on Agricultural Research for the Year Ending June 30, 1936. Part I. Project Reports, Publications, Staff, Financial Statement. Part II. Iowa Corn Research Institute First Annual Report," Agr. Exp. Sta., Ames, Iowa, R. E. Buchanan, Director.

"The Effect of Electric Current on Certain Crop Plants," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 210, Mar. 1937, Charles S. Dorchester.

"Home Vegetable Gardening in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 181, Jan. 1937, Walter B. Balch.

"Annual Report for the Fiscal Year Ending November 30, 1936," Agr. Exp. Sta., Amherst, Mass., Bul. 339, Mar. 1937, Fred J. Sievers, Director.

"Seventy-fifth Annual Report of the Secretary of the State Board of Agriculture and Forty-ninth Annual Report of the Experiment Station," Agr. Exp. Sta., East Lansing, Mich., John A. Hannah and V. R. Gardner.

"Soybean Production in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 161, June 1937, C. R. Megee.

"4-H Garden Club Suggestions," Agr. Ext. Serv., East Lansing, Mich., Club Bul. 34, May 1937, P. G. Lundin.

"Evergreens," Agr. Ext. Serv., East Lansing, Mich., Bul. 178, May 1937, Charles W. Barr.

"Agricultural Research Through Fifty Years," Agr. Exp. Sta., University Farm, St. Paul, Minn.

"Forty-third Annual Report, July 1, 1935, to June 30, 1936," Agr. Exp. Sta., University Farm, St. Paul, Minn., Andrew Boss, Vice Director.

"Duluth Potato Crops Through Three Seasons (1934-36, Inclusive)," Agr. Exp. Sta., University Farm, St. Paul, Minn., Mimeo. Northeast Exp. Sta., M. J. Thompson, Supt.

"The Cloquet Forest," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 112, Jan. 1936, T. S. Hansen, J. H. Allison, R. M. Brown, E. G. Cheyney, and Henry Schmitz.

"A Study of the Relative Adaptation of Certain Varieties of Soybeans," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 255, May 1937, J. M. Poehlman.

"An All-Year Pasture System for Missouri," Agr. Exp. Sta., Columbia, Mo., Cir. 193, Feb.

1937, W. C. Etheridge, C. A. Helm, and E. Marion Brown.

"Blooming and Ripening Dates with Yields of 360 Varieties of Apples Grown at Mountain Grove, Missouri," St. Fruit Exp. Sta., Mountain Grove, Mo., Cir. 25, Mar. 1937, Paul H. Shepard.

"Blooming and Ripening Dates with Yields of 167 Varieties of Grapes Grown at Mountain Grove, Missouri," St. Fruit Exp. Sta., Mountain Grove, Mo., Cir. 27, May 1937, Paul H. Shepard.

"Crop Regions in Montana as Related to Environmental Factors," Agr. Exp. Sta., Bozeman, Mont., Bul. 340, May 1937, L. P. Reitz.

"Serving New Hampshire Farms and Homes, Annual Report of Director for 1936," Agr. Ext. Serv., Durham, N. H., Ext. Bul. 51, Apr. 1937, J. C. Kendall, Director.

"Adjusting Feed Practices to Reduced Milk Incomes," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 195, Jan. 1937, E. F. Eastman.

"Conservation Practices for Farm Woodlands," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 196, Jan. 1937.

"Better Hay Practices," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 197, Feb. 1937.

"Conservation Program on Fruit and Vegetable Farms," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 200, Feb. 1937.

"Solvi..g Early Garden Problems," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 202, Mar. 1937, J. R. Hepler.

"Fifty-seventh Annual Report of the New Jersey State Agricultural Experiment Station and the Forty-ninth Annual Report of the New Jersey Agricultural College Experiment Station for the Year Ending June 30, 1936," Agr. Exp. Sta., New Brunswick, N. J., J. G. Lipman.

"Soils in Relation to Fruit Growing in New York. Part X. Susceptibility of Various New York Orchard Soils to Reduction Upon Waterlogging," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 667, Mar. 1937, Michael Peech and Damon Boynton.

"Producing Quality Burley Tobacco in North Carolina," Agr. Ext. Serv., Raleigh, N. C., Ext. Cir. 214, Apr. 1937, E. Y. Floyd.

"Cultural Systems for the Apple in Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 580, May 1937, C. W. Ellenwood and J. H. Gourley.

"Peach Production in Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 581, May 1937, Leon Havis and J. H. Gourley.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXII, No. 186, May-June 1937.

"Permanent Pastures for South Carolina," Agr. Ext. Serv., Clemson, S. C., Bul. 99, Mar. 1937.

"Abstracts of Bulletins 523-538, Circulars 77-78, and Other Publications During 1936," Agr. Exp. Sta., College Station, Tex., Cir. 79, Mar. 1937, A. D. Jackson.

"Small Grain and Rye Grass for Winter Pasture," Agr. Exp. Sta., College Station, Tex., Bul. 539, Apr. 1937, R. H. Stansel, P. B. Dunkle, and D. L. Jones.

"Factors Affecting the Amount of Puffing in Tomatoes," Agr. Exp. Sta., College Station, Tex., Bul. 541, Apr. 1937, S. H. Yarnell, W. H. Friend, and J. F. Wood.

"The 4-H Garden in Vermont," Agr. Ext. Serv., Burlington, Vt., Cir. 89, June 1936, Paul R. Miller.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 349, June 1937, and Bul. 350, July 1937.

"Reed Canary Grass Good for Hay and Pasture," Agr. Ext. Serv., Madison, Wis., Sp. Cir., Mar. 1936, E. D. Holden.

"Better Yields on Central Wisconsin Soils," Agr. Ext. Serv., Madison, Wis., Sp. Cir., Feb. 1937, F. L. Musbach and C. J. Chapman.

"Tobacco Culture," U. S. D. A., Washington, D. C., Farmers' Bul. 571, Rev. Sept. 1936, W. W. Garner.

"Growing Black Locust Trees," U. S. D. A., Washington, D. C., Farmers' Bul. 1628, Rev. May 1937, Wilbur R. Mattoon.

"Effect of Method and Rate of Grazing on Beef Production and Plant Population of Pastures at Beltsville, Maryland," U. S. D. A., Washington, D. C., Tech. Bul. 538, Jan. 1937, M. A. Hein and A. C. Cook.

"Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations," U. S. D. A., Washington, D. C., Misc. Pub. 254, Mar. 1937, Mary A. Agnew.

Economics

The status of the potato enterprise in northern Indiana counties is summarized in Bulletin No. 412, Purdue University Agricultural Experiment Station at Lafayette, Ind., "Economic Analysis of Potato Production in Northern Indiana," by Lynn Robertson.

While Indiana is not generally considered an important potato-producing state, the bulletin points out that on many farms in the northern counties of Indiana the potato enterprise constitutes a rather important source of cash income. The soil and growing conditions are more suitable to the crop in this section of the state, and practically all of the counties in the northern half of Indiana have shown an upward trend in potato acreage,

while the counties in the southern half of the state have decreased their acreage. One reason for the better adaptability of the northern counties to potato production is the fact that the soils average coarser in texture than farther south in the state. Many of the upland soils are fairly productive, even though some are deficient in fertility, organic matter, and water-holding capacity. Also within this 22-county area, there are approximately 300,000 acres of muck soil, most of which, when adequately drained, is very well suited to potato production. Another important soil type is the comparatively large acreage of fertile, dark sandy lowland soils on which potatoes may be grown at an advantage.

The average yield per acre of potatoes over the 10-year period from 1921 to 1930 is considerably lower than in some of the important states, such as Maine, but Indiana yields as a whole compare quite favorably with other potato-producing states in the Midwest, such as Michigan, Wisconsin, and Minnesota.

Another reason for the growing importance of the potato crop in northern Indiana is the relatively large urban area within the district and in the immediate surrounding territory, constituting a very good market for potato crops.

The early potatoes grown in northern Indiana are usually put on the market about the first of July, thus giving an advantage of several weeks over the early potatoes from Minnesota, Wisconsin, and Michigan. Even though the location helps, the late potatoes have relatively less advantage than the early potatoes. Because of the comparatively favorable location, prices received for potatoes by farmers in Indiana are usually higher than prices received in a number of the most important surplus potato-producing states.

In the summer of 1934, cost of production records were kept on 56 farms where late muck potatoes were grown, on 18 farms with late upland potatoes, 15 farms with early muck potatoes, and 15 farms with early upland potatoes. A summary of these cost of production records furnishes an average unit requirement and cost of producing an acre of potatoes on each of the respective soil types. In that year, the total growing cost on the late muck farms was $54.07 an acre, on the upland farms $42.54, and on the early muck farms $58.98, and on the early upland farms $51.48. Even though the acre cost was higher on the late muck farms, the unit cost was less, due to the higher yield, yields being 197 for the muck farms, and 143.2 bushels per acre for the upland farms, and the growing costs per bushel, 27 cents and 30 cents, respectively. In the case of early potatoes, the reverse was true, the yield being low on the muck farms—91.4 and 107.5 bushels, respectively—with a growing cost of 65 cents for the muck farms, and 48 cents for the upland farms.

The records disclose that each class of potatoes made a profit above all costs, with the exception of the early muck potatoes which cost more per acre to produce than the other classes, largely because of higher charges for fertilizer, seed treatment, and spray material. However, it was pointed out that in view of the limited number of records in this particular group, as well as in the early upland potatoes, the figures could not be accepted necessarily as giving a representative figure of the whole northern Indiana potato-producing area. For other years the cost of production of potatoes in this area could be estimated by substituting the physical factors of production at the current costs.

A most important factor affecting cost was the yield per acre. This appeared to have more influence than any other single factor. Among the most important factors which seem to have the greatest influence on yield

were the kind and amount of seed used, thoroughness of seed-bed preparation, amount and kind of fertilizer used, the amount of tillage of land before inter-row cultivation. Other factors which had less influence were not as easily measurable from the records. It was found that according to these records the fertilization was a very important factor in lowering production cost. On 17 late muck farms where no commercial fertilizer was used on potatoes, the average yield per acre was only 159 bushels, as compared to an average of 220 bushels on farms on which potatoes received 300 pounds of fertilizer per acre. And the fields receiving applications of 100 to 299 pounds of fertilizer per acre gave an average yield of 163 bushels. The mixture which seemed to be very well adapted to late muck potatoes is an 0-8-24. Eighteen of the 40 growers who fertilized used this mixture, or very similar analyses. Barnyard manure did not seem to be particularly beneficial to potatoes grown on muck soil. According to the Bulletin, the potential market outlet for the northern Indiana potatoes can be effectively developed through uniform grading practices, using new and attractive sacks, and through effective advertising.

"Cost of Producing Apples in Berrien County, Michigan, 1935" is the title of Michigan's Special Bulletin 286. The bulletin reports the results of a study by K. T. Wright of the Farm Management Department, and W. R. O'Brien of the Horticultural Department of the College of Agriculture. Some interesting features of the development of the apple industry in Michigan are noted in the introduction. In the past 30 years there has been a 50 per cent reduction in the number of bearing apple trees in the state, while in the whole United States the total of bearing apple trees has decreased about 55 per cent. Of further significance is the fact that there has been a shifting of the location of the apple-producing area in Michigan. Decreases have occurred in the number of orchards in the counties of the central and southeastern portions of the state, with moderate increases along Lake Michigan from Oceana north to Emmet. In Berrien County, where the study was conducted, the number of apple trees decreased from 466,000 in 1890 to 273,000 in 1910, but increased to 435,000 between 1910 and 1930.

Even though the changes in the numbers of trees from year to year are very small, wide fluctuations in production occur. The average yearly production of apples in Michigan between 1930 and 1934 was 7,327,000 bushels, which places the state sixth in the production of apples.

The objects of the study were: first, to determine the cost of producing, harvesting, marketing, and overhead items in a Michigan county of importance in apple production; second, to determine the amount of labor and materials used in production in order that current prices could be applied to these amounts to obtain average costs at any later date; third, to make a farm management study of some economic phases of apple production; and fourth, to study the relationship between the conditions of management practices and the efficiency of apple production and net returns.

The data for the study were secured through record books kept by cooperating farmers. A complete record was kept on all of the items pertinent to the production of the apple crop. To insure accuracy and completeness, each farmer was called upon about every two weeks through the 1935 season and given assistance with his records. In the fall, after the marketing season, the records were collected and summarized at the college. Jonathan, Delicious, and Wealthy were the three leading varieties grown by the Berrien County producers.

The most important items of cost in the production of apples in this

section of Michigan were labor, power, and machinery, which made up more than 32 per cent of the total. The next most important was packaging and marketing, which constituted about 22 per cent of the total cost. This was followed by interest on trees and land, representing 21 per cent. Spraying material accounted for 11.3 per cent; and other items, for 13.7 per cent.

For purposes of comparison between high- and low-cost orchards, the records were grouped in two classes: the 15 most profitable, and the 15 least profitable. In 1935, the most profitable farms produced the highest yield and the greatest percentage of No. 1 apples—290 bushels total per acre. A total yield of 107 bushels per acre was obtained on the low-profit farms. In 1934, the average yield was 197 and 156 bushels, respectively, and in 1933, 254 and 107 bushels. The high-profit farms used considerably more spray on the average than the low-profit farms. The production costs per acre were higher on the high-profit farms, but the cost per bushel was much lower. The total cost per bushel on the high-profit farms was 47 cents in 1935, and on the low-cost farms it was 84 cents, which made a difference between the profit of $43.32 per acre on the high-profit farms as contrasted to a loss of $36.83 on the low-profit farms. The most profitable farm was carefully analyzed from the standpoint of practices which might have resulted in placing it in this position relative to the others.

The orchards were further divided on the basis of the age of the trees, and the cost per acre by age of bearing trees was also calculated. The yield factor was an important one in determining the unit cost, and in general it was discovered that a 100 per cent increase in production cost usually resulted in a 600 per cent increase in yield, as compared to different orchards under less efficient management.

"1936 Orange County Lemon Production Cost Analysis. Eleventh Year Summary 1926-1936," Agr. Ext. Serv., Berkeley, Calif., Harold E. Wahlberg.

"1936 Orange County Valencia Production Cost Analysis. Eleven-Year Summary 1926-1936," Agr. Ext. Serv., Berkeley, Calif., Harold E. Wahlberg.

"Commercial Fertilizers and Agricultural Minerals, 1936," St. Dept. of Agr., Sacramento, Calif., Sp. Pub. 146, A. A. Brock, Director.

"Florida Citrus Costs and Returns," Agr. Ext. Serv., Gainesville, Fla., Citrus AT 6, June 1937, R. H. Howard.

"Economy in Buying Fertilizers," Agr. Exp. Sta., Experiment, Ga., Pr. Bul. 448, May 18, 1937, R. P. Bledsoe.

"Illinois Farm Economics," Agr. Ext. Serv., Urbana, Ill., Nos. 24 and 25, May and June 1937.

"Indiana Crops and Livestock — Annual Crop Summary 1936," Dept. of Agr. Statistics, West Lafayette, Ind., No. 135, Dec. 1936.

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Fertilization of Bulb Plants

BULB plants, such as tulips, hyacinths, narcissi, and crocuses require fertilizers high in potash, according to the experiments of Dutch growers. Bulbs originally were grown in Holland on sandy soils very low in organic matter or humus. Later, the industry spread to the clay soils and even to the peats and mucks, but results were not satisfactory in these cases. At the present time, bulb growing is restricted largely to the sandy soils. From this it will be seen that there is comparatively little natural fertility in the soils used for this crop. The nutrients, therefore, must be supplied almost entirely by commercial fertilizers.

Fertilizer containing about 100 pounds nitrogen, 100 pounds phosphoric acid, and 300 pounds of potash (a 1-1-3 ratio) per acre is recommended in Holland. This would correspond to a 5-5-15 fertilizer at the rate of 1 ton per acre. This may sound rather odd to some agronomists in this country, but it is interesting to note that this ratio is similar to that found to be most favorable for sweet potatoes by the Norfolk Truck Experiment Station. Sweet potatoes, so far as fertilizer requirements are concerned, tend to correspond to bulb plants, and the soil at Norfolk, Virginia, probably as much as any in this country, corresponds to that in Holland. It would therefore appear as though the 5-5-15 fertilizer analysis would also be quite satisfactory here. In case a 5-5-15 cannot be obtained, a 4-8-12 tobacco fertilizer probably would give quite satisfactory results.

The materials preferred by the Dutch growers are dried blood and sulphate of ammonia for nitrogen, Thomas Meal (basic slag) or superphosphate for phosphoric acid, and sulphate of potash-magnesia or sulphate of potash for potash. Some

growers use nitrate of soda and muriate of potash also. A satisfactory formula for bulb fertilizer might be 300 pounds of 12 per cent blood, 320 pounds of sulphate of ammonia, 570 pounds of 18 per cent superphosphate, 60 pounds ground limestone, 440 pounds sulphate of potash-magnesia, and 310 pounds 95 per cent muriate of potash. On heavy soils the phosphoric acid probably should be higher, in which case 100 pounds of ammophos 11-48 or similar material might be substituted for 100 pounds of blood. The fertilizer should be applied at the rate of about 1 ton to the acre or 45 pounds per 1,000 square feet, in the fall or early spring.

Individual varieties of bulb plants are not exactly equal in their demand for lime. Hyacinths, for example, prefer a soil that is neutral with a pH of about 7. Many narcissi grow better in a more or less sour soil. Golden Spur, for example, and Dubb. v. Sion prefer a pH of 5 to 6 and grow poorly at pH 7.5. Tulips grow as well on acid as sweet soils.

Potash Pays on Prunes and Apricots

THE need for potash and other fertilizers on prunes and apricots can be determined by examination of the trees and fruit as well as by testing the soil. Careful observations and field trials have shown that the trees really speak a language which, when correctly understood and acted upon, enables the orchardist to increase his profits through improved yield and quality of his fruit.

A fruit grower in the Campbell district of California was greatly worried over the poor quality of the prunes his trees were producing. The quality of the fruit had been steadily deteriorating for several years and, as the grower stated, "the more fertilizer I used, the poorer was the quality of my prunes." It developed that he had used only sulphate of ammonia and he was being urged to use more of it. The prunes told their story very definitely by their heavy shrinkage on drying, lack of sugar and almost worthless quality, all running to small undesirable sizes.

The grower was advised to apply 2 pounds of actual potash to each tree as soon as possible, and he acted upon this advice without delay. The following summer he reported a visible improvement in the appearance of his orchard and fruit. In the fall he stated that his prunes were two to three times as large as they had been in the past and the quality was unexcelled. Neighbors would not believe the story of this improvement until they examined the orchard themselves. So striking were the results obtained that many of these doubters decided that they also should use potash on their trees.

The effect of potash on this man's apricots also was marked, especially in improving the shipping quality of the fresh fruit. In previous years, as he expressed it, "apricots, falling on the ground, smashed, forming a pancake and consequently were worthless." This year the fruit, falling to the ground, was so firm and maintained its shape so well, that it was all usable. This meant that all the crop could be sold which represented a considerable increase of income from this factor alone. In addition to this, all the fruit was larger in size with better color and with improved shipping quality.

New, Better Vegetables is Aim of Plant Breeder

Tastes and preferences in vegetables are highly localized, both in this country and in other countries, says the United States Department of Agriculture 1937 Yearbook, part of which is devoted to the breeding of new and better vegetables. Many vegetables commonly eaten in Asia are unknown in the United States. In some countries American sweet corn is not considered fit for human food.

Although the Division of Plant Exploration and Introduction draws on the whole world for new plants, these are used mostly to breed specific characteristics into vegetables that already are favorites, in order to improve them in disease resistance, quality, or other characteristics.

Systematic vegetable breeding, carefully and scientifically planned by public agencies in this country, is comparatively new, says the yearbook, but individuals and commercial firms for many years have produced better vegetables, largely by what is known as mass selection, though there has been some by hybridization.

The new Federal station at Charleston, S. C., is devoted exclusively to breeding better vegetables. It is concerned with vegetable problems in the Southeast. At Cheyenne, Wyo., the Great Plains Horticultural Field Station is engaged in a breeding program to extend the meager list of vegetables now adapted to trying conditions of the Plains.

85 Per Cent of Soybean Crop Is Used by Industry

At present 85 per cent of the Illinois 5-year average soybean crop of 9,660,000 bushels is utilized commercially, whereas 10 years ago only 15 per cent of the crop went into industrial uses, according to J. C. Hackleman, crops extension specialist, Illinois College of Agriculture.

In his office Professor Hackleman has 50 different products all made from soybeans and all commercially available. It is the further refinement of the two primary products, oil and meal, that makes the many useful products available.

Among the edible products made at present from the whole bean are roasted beans, coffee substitutes, soy-sauce, soybean milk and cheese. Soybean meal is used for stock feed, fertilizer, and for such human food products as flour, sausage flour, macaroni and spaghetti, breakfast foods, infant and diabetic crackers, cakes, bread, and muffins. Other edible products from the soybean are salad oils and lard and butter substitutes.

Although the development of industrial products from soybeans has just started, Professor Hackleman has samples of products now commercially available in which soybeans have been used successfully in the manufacture of paint, enamel, varnish, glycerine, explosives, linoleum, water-proof goods, celluloid, rubber substitutes, printer's ink, lighting oil, lubricating oil, and soaps.

Besides playing an increasingly important part in industry, the soybean, a legume, has a place in any soil conservation program. Thousands of acres of soybeans were plowed under as green manure this year as a result of the emphasis placed on this practice by the new farm program."

Crop Rotations a Simple Way to Control Disease

Crop rotation is a simple way to keep plant diseases under control, but one of the best, according to United States Department of Agriculture crop specialists.

Rotating a wilt-resistant variety of flax with small grains and corn is one example. Flax, although grown like a small grain crop, belongs to a family of plants widely separated from the grass family to which wheat, oats, barley, rye, and corn belong, and is not attacked by the same diseases that injure grains. Flax has its own diseases such as rust, wilt, and leaf spot, but these in turn do not attack small grains. A variety of flax susceptible to wilt, however, must be grown on clean land, as ordinary rotations do not destroy the wilt organism in flax-sick soil.

Many diseases of cotton are checked by growing other crops. In cotton fields in Texas, where root rot is serious, losses may be reduced by rotating with grain crops and by deep tillage. Cotton wilt is one disease, however, which has not been successfully checked by changing crops, though rotation with soil building crops is an important supplemental factor in decreasing wilt damage and increasing yields. Wilt has been found in cotton in a field that had not been in cotton for several years.

Root knot of tobacco is checked by rotating with peanuts, croatalaria, oats, or a natural weed fallow. Granville wilt of tobacco is controlled by growing corn, cotton, or sweet potatoes. Department men have found that a 4-year rotation with ordinary field crops checks black shank of tobacco in western North Carolina. This rotation does not work in Florida, however.

Disease specialists say that the very simplicity of rotations often cause them to be overlooked as a method of checking plant disease. Many farmers keep on with a particular crop, the infection increasing year by year.

Cranberry Jumps Barrier to Show Good Condition

Before a cranberry is shipped it must prove its vitality and fitness for market by bouncing over a barrier. This is the way the berries are graded. Those that have decayed or otherwise deteriorated will not bounce when they are allowed to drop a short distance. All grading is done by machinery and the berries are given about four chances to bounce over the barrier. The problem that scientists of the United States Department of Agriculture are attempting to solve is how to retain this quality bounce in the cranberry after it has been in storage from 2 to 4 months. As it is one of the most costly crops to produce, it is important to the grower to market as large a percentage of the crop as possible after the long storage period.

Harvest of the crop generally starts in the late summer or early fall, depending on the variety and the locality in which the berries are grown. The best consumer demand, however, comes around Thanksgiving and Christmas and for this reason a large part of the crop must be stored. Heavy losses from decay while in storage are often experienced.

After testing a large number of samples, at temperature ranges from 30 degrees F. to 70 degrees F. scientists have concluded that holding the

berries at 36 degrees F. reduced decay and breakdown to a minimum. Berries held at this temperature also retained the most attractive color.

Most storage houses are now insulated and equipped with proper ventilation, but few have refrigeration. In recent years, however, consumer demand has gradually lengthened the marketing period, which now continues long after the holiday season. To take care of this consumer demand, the growers wanted to know about storage temperatures and conditions.

The test showed that when the temperature was held at 36 degrees from 65 to 73 per cent of the berries were in good condition at the end of 4 months. Over 90 per cent were rotten when held at a temperature of 70 degrees. As a result the consumer may obtain "bouncing" berries all through the winter months.

Minor Elements in Cotton Fertilizers

(*From page* 16)

limestone as a filler to correct the equivalent acidity of a fertilizer. The experiment was located at 11 points in the state and has been run for 3 years. Calcic limestone increased the yield of cotton only 26 pounds per acre, while dolomitic limestone increased it 94 pounds per acre.

In all three of these experiments there are possible secondary effects which may account for all or part of the increase noted. Where magnesium sulphate was used, the sulphur may have increased yields. The poor results obtained with calcic limestone compared with dolomitic limestone may have been due to the reversion of some of the phosphate in the fertilizer to a less available form. However, considering the results from all three tests it seems probable the magnesium is a needed element in cotton fertilizers on most soils.

Ten pounds of borax were applied to cotton as a side-dressing at five locations. There was a small increase on one location but not enough to be significant. At the other locations there was a decrease.

Six pounds of copper sulphate were applied to cotton at seven locations in the state over a 2-year period. No beneficial results were noticed.

Only one experiment has been run with manganese and zinc, but this has been over a 7-year period. A small increase was obtained from manganese when used with limestone. No increase was obtained where limestone was not used. The experiment will have to be repeated in other locations to make sure of these results.

Minute quantities of zinc have been found to cure rosette in pecans around Albany, Georgia. It is not known as yet whether cotton needs zinc. In the one experiment in which this element was used no beneficial effects were noticed.

As far as these experiments go, the results indicate that cotton fertilizers should contain a fairly large amount of calcium and magnesium on some soils, and possibly a small amount of sulphur. While these three elements are often supplied in ample quantities in commercial fertilizers at the present time, one or more of them are often omitted, especially when concentrated fertilizers are used. While our knowledge of the needs of these three elements in cotton fertilizers is admittedly meager, the above experiments indicate that it would be safest to include them. Fortunately, they can be included without increasing the cost of the fertilizer.

There is as yet no evidence to show that boron, copper, manganese or zinc is needed on the average cotton soil. It is possible that where heavy applications of limestone are made manganese and some of the other minor elements may be beneficial.

High Potash Fertilizers for Fall Use

(*From page* 18)

eral elements at seeding time, a longer period of production of this crop can be maintained.

Orchard Cover Crops: Plenty of organic matter in the soil is an important factor in maintaining soil fertility and healthy trees. Fruit growers generally recognize a lack of nitrogen in their trees. Less often do we hear of them complaining of a lack of phosphate or potash, but we often hear of reduced yields, spindly and weak wood growth, poor shapes, poor keeping qualities, cracking of the fruit, water core, fruit pit, cork or drought spot, die back, and top and root injuries during the winter. According to research workers these are often the result of a soil fertility that is out of balance. It may be that too much nitrogen has been used, which practice sooner or later exhausts the reserves of the mineral elements potash, phosphate, and lime. Then the trouble starts. The lack of the mineral elements in turn limits the growth of cover crops, especially the legumes so necessary for the maintenance of organic matter in the soil and proper water-holding capacity.

Increase Organic Matter

On light soils and in older orchards on the heavier soils, especially where no particular attention has been given to building up the supply of organic matter, the immediate problem most likely is growing a cover crop to increase the supply of organic matter. To procure a satisfactory growth of cover crops under conditions found in many old orchards will probably require liberal applications not only of nitrogen but of phosphate, potash, and possibly lime in addition.

The excellent work of the Pennsylvania State College published in Bulletin 294 and similar work at the Virginia Experiment Station published in Bulletin 279 emphasize the importance of proper fertilization involving the minerals necessary for a good growth of cover crops. HofMann of Virginia notes that "generally cover crop responses are the first to be observed as benefits from complete fertilizer application."

Consider the Legume

If a sweet clover, alfalfa, or other legume cover crop is used, the mineral requirements of these crops must be considered very carefully. Legumes require large amounts of phosphate, potash, and lime for best growth. Before seeding in the late summer or early fall, if it has been difficult to obtain a good stand of legumes, a phosphate-potash mixture should be applied. This will help in stimulating the growth of the green manure crop. When plowed under, the decomposition of the cover crop will make the minerals available in the soil at a lower depth than if fertilizer is applied only to the surface. If potash deficiency has shown itself in the trees, enough fertilizer should be applied per tree to supply at least a pound of actual potash to each tree.

Field surveys of the mineral content of different soil areas where orchards are located have shown that the available mineral level is often lower than it should be for profitable crop production. If an orchard is in this class then it may be necessary to apply extra amounts of minerals until the proper level of available fertility is restored. Using phosphate-potash mixtures on fall wheat, legume hay, and orchard cover crops are practical methods of bringing the mineral level of soils up to a point where profitable crop production is possible.

Shall It Be Soil-mining or Soil-building?

(*From page* 14)

Tabulated below are data to show average benefit the first year following the application of fertilizer on the hay crops. Average increases for 22 of the same farms included in Table 3 are shown.

TABLE 4. FIRST-YEAR RESIDUAL BENEFIT TO HAY CROP

No. of farms	Increased yield 2 cuttings 0-20-0	Increased yield 2 cuttings 0-20-10
22	543 lb.	917 lb.

It will be observed that there has been an average increase for 20 per cent superphosphate of 543 pounds. Where potash was added to the phosphate, an increase of 917 pounds resulted. With hay valued at $12 per ton, the increased yield resulting from phosphate treatment would be $3.25. In the case of the phosphate-potash treatment, a value of $5.50 was obtained. This really is pure gain, since the fertilizer more than paid for itself the year previous in increased yields of grain.

Combat Soil Depletion

Our soils are being rapidly depleted of organic matter and becoming more and more acid in character. They have lost their humus through the growing of soil-depleting crops, such as corn, small grains, and cash crops. Unless immediate steps are taken to stop these losses, unless we shift more of our land from soil-depleting to soil-conserving crops, unless we resort to the use of more fertilizers and lime in maintaining a balanced state of fertility, the future prosperity of farmers in Wisconsin is in real jeopardy.

By liming we are laying the foundation for more productive soils. Lime not only corrects acidity but also supplies available calcium to our lime-loving crops. It is also helpful in making other plant foods available, especially phosphorus. Liming acid soils stimulates bacterial life, thereby helping to make the plant food contained in organic matter available to growing crops. The liming of our soils will improve their texture; will produce a more friable, granular soil.

Acid Land Needs Lime

During the past 3 years something better than 2,000,000 tons of lime have been produced and applied to Wisconsin farms under our State and Federal lime production program, but this amount is sufficient to cover not more than 10 per cent of the acid soils in the state. It is estimated that less than 20 per cent of the farm lands in Wisconsin have been limed. There are still better than 6,000,000 acres of acid, lime-deficient soils in the state. Repeating the application even at the rate of 1,000,000 tons per year, we would be just barely maintaining a lime balance in our soils. Even when we have covered every acre of acid land on our farms, it will be found desirable to start right in again and relime most of our soils.

While it is true that liming is a basic step in a soil-building program, yet by reason of the stimulating effect that lime has on most acid soils, we are really pumping the soils harder and harder. In fact, the liberal use of lime will make the need for phosphate and potash greater. And right here permit me to observe that the liming of our soils, the growing of more alfalfa (a heavy potash feeder) will reduce the amount of purchased feeds and thus further accentuate the need for more commercial plant foods. Already this situation exists. The acreage of alfalfa in Wisconsin has doubled

during the past 3 years. We harvested better than 1,000,000 acres of this great crop in 1936 and again in 1937. And this all means heavier demands on the mineral resources of our soils.

The Federal Government is now engaged in a gigantic program of soil conservation. A program for the control of wind and water erosion has been set up in every part of the United States. Large scale erosion control demonstration projects are being established. Hundreds of engineers and agriculturists have been hired to supervise this work. Our CCC boys are doing much of the physical work in remodeling farms and watersheds, building terraces and dams, and planting trees for shelter-belt protection as a means of controlling wind and water erosion.

Our soil conservation and crop control program (successor to the AAA) is just another approach to conservation. It is true farmers are being paid to shift acreage from soil-depleting to soil-conserving crops, being paid to seed down their land to pasture and hay crops, and being paid to use lime and fertilizers in a constructive soil-building program.

Most farmers right now have signed up on this program primarily because they can earn in benefit payments $40, $50, or $100. But really these better soil-management practices are justifiable on the basis of added income and long-time productiveness of their soils.

The Federal Government is really playing the role of a benevolent and provident parent who sees danger and possible destruction ahead if his wilful children continue in the way they have been going. But rather than let its children suffer the consequences of their wrong-doing, the Government is now nurturing, feeding, and guiding them in right habits of soil building, which is laying the foundation for future prosperity.

Practices Proving Sound

It is indeed gratifying to me, a soil specialist, who for years has been talking lime, fertilizers, more alfalfa, and better yields of grain and corn, to see my feeble voice caught and amplified on a wave of 10,000 loud speakers which are broadcasting the story of soil fertility to every county in the State of Wisconsin. And I now sit back with a feeling of comfortable satisfaction and know that the results from these new practices for which farmers are being paid will prove them fundamentally sound, and that even after Federal subsidy has been withdrawn farmers will continue these better soil-management practices, because they pay.

Atkinson Demonstrates That It Can Be Done

(*From page 9*)

The purchase and use of the new fertilizer distributor by Mr. Atkinson was in line with his policy to utilize the proved results of research and to get the best possible return from the application of fertilizer.

Five great institutions, the National Joint Committee on Fertilizer Application, the National Fertilizer Association, the Farm Equipment Institute, State Agricultural Experiment Stations, and the U. S. Department of Agriculture have cooperated in research to find the best way to place fertilizer.

The U. S. Department of Agriculture reported that the investigators got the best results with cotton under average conditions when the fertilizer was placed in a narrow band about

2½ inches to the side of the row and 2 inches deeper than the seed. Fertilizer on one side of the cotton row proved to be as good as fertilizer on both sides of the row.

Potatoes yielded about 30 to 35 bushels more per acre when the fertilizer was placed at each side of the row compared to placements under the seed or mixed with the soil around the seed. The fertilizer was placed in a band 2 inches to each side of the seed piece and a little deeper than the seed piece.

The Department reported that with tobacco, the research in certain southeastern experiments showed an indicated increase of $55 to $70 in the per acre value of the crop when the fertilizer was placed at each side of the row instead of under the tobacco plants or mixed with the soil around the plant roots. The best results were obtained when the fertilizer was placed in a band 2½ inches to each side of the tobacco plant and one inch below the root crown.

In their work with row crops, the side placement of the fertilizer gave the best results when the crop got little rain during germination of the seed. The advantage of side placement was not always noticeable when the fertilizer application was small, when considerable rain fell after planting, or when the crop was planted on heavy soil.

Fertilize to Control Cotton-belt Erosion

(*From page* 22)

eroded land also respond well to nitrate top-dressings. Experiments show large and very profitable increases and excellent erosion control from the use of phosphates on pastures with a Bermuda grass base. Phosphate increases the winter cover of white, hop, and bur clover and lengthens the grazing period of Bermuda pasture. No doubt adding lime and potash to phosphated pastures would pay, as a complete fertilizer has been profitable on several Bermuda and winter legume pastures.

In the past, the value of commercial fertilizers has been determined solely

Farmers inspecting a luxuriant growth of hop, bur, and white clover on a fertilized Bermuda grass pasture at the Cotton Branch Experiment Station, Marianna, Arkansas, April 16, 1937. Per-acre gains in weight of beef cattle have averaged 592 lbs. on this pasture for the last three seasons, or 154 lbs. more than on an adjoining unfertilized pasture.

on the basis of increases in crop yields and quality from the use of these materials. In the future, commercial fertilizer is destined to assume a new role, that of maintaining present crop yields by increasing vegetal cover for holding topsoil in place and keeping fertility at present and higher levels. Fertilizer for cotton belt erosion control can be made a powerful weapon against the ravage of this most destructive enemy of our greatest asset, topsoil. Its use will be as one of many other good Soil Conservation practices rather than as a substitute for these practices.

Growing Herbs in the Family Garden

(*From page* 20)

flowers. For example, the various purslanes, or Portulacaceae, because of their fleshy red stems are relished in salads. They are colorful but somewhat neutral in taste. Salad burnet is another delightfully scented herb with a mild cucumber flavor that might be included in salads. The petals of the common marigold are claimed to be an interesting addition to a salad. Nasturtiums also are used by some in salads. The blue-flowered rampion is another herb that is used in salads. It is used both as a vegetable and as seasoning.

Any garden, regardless of its size or condition, that includes most of the herbs mentioned herein could rightfully be classed as an herb garden. Many growers interested enough to include a majority of these herbs would find themselves becoming herb enthusiasts after a few years, and would probably wish to increase the number of these interesting plants.

Much has been written in regard to herb gardens, but a large part of the discussion concerning them has been in a romantic vein—a very unscientific approach, to say the least. There is nothing that the ordinary gardener cannot understand about growing herbs. They grow like other plants. Possibly there may be some wizardry involved in their utilization in a medicinal way, but this article is not concerned with "simples," the name often attached to medicinal herbs. It is hoped that it will serve to arouse a genuine interest in herbs for kitchen use, both because of the joy to be found in growing these unusual and attractive plants, and their genuine usefulness in relieving the salt-and-pepper flavor common to so many present-day American foods.

Sand Country

(*From page* 6)

tures into fantastic turrets and minarets, shading from dull brown to coppery red, peer up in grim silence over border plots of juniper and pine. These were admired by the vagrant French voyageurs of Injun trading days, who graced them with fancy Gallic names.

The open fields are colorful, too, tinted with meager, gray, sand grasses, blued with wild pea-vine tangles, and rosy-toned with spreading clumps of

sorrel. In early June, I last traversed the zone, and my eyes could hardly keep the road for the attractiveness on either side.

Flaming clusters of squaw paintbrush, or hoary puccoon; rank, blue-stemmed, sticky liverwort; dainty wild phlox; gorgeous purple lupines on tall spikes; and ranks of white flowered locust trees and snowy thornapple branches scent the drowsy air. The distant coo-coo of the mourning dove and the squeak of the gopher alike brought memories of barefoot times long gone.

Now maybe it wasn't so tough on the Injuns after all, to be shifted by the government, like a soil-depleting crop, over into these silent, flowery, and forgotten places. Sands too have their compensations.

They say that plants in sand must sink in their roots pretty deep, and that you can't transplant some sand herbage and make it thrive elsewhere. Perhaps it's that way too with us folks who come of a sand-land heritage.

MY PARENTS and their folks came west from New York and New England, passed calmly over some of the fine, black loam soils of the prairies, and finally squatted in the best spot of building sand known to the architects. Wood and water were the cravings of raw pioneers, and these were found in abundance then in the light soil areas.

Here they were raised with the jackrabbits and the Injuns, and the only difference was that the government expected my folks to pay taxes, allowing the redskins all the sand and peat they wanted just for keeping quiet. And in that way somehow we all absorbed the nature of the place and got sand and solitude into our systems.

I suppose for one thing, though we didn't know any better, we sort of appreciated living in such a pretty place and enjoying the few things we had. This concept of farm life is outmoded, naturally, and people nowadays believe that laws and organizations will protect them in their battle with nature and their own ignorance. Likewise they don't usually take as much pride and comfort over sitting down to a meal of "home products," and they depend on the bakery and the butcher shop for more staples than we were wont to do.

WHILE I am not arguing for a return of primitive and uneconomic situations, I am certain that the possession of a simple home in a meager land meant more to us than the luxuries accepted as commonplace justice by masses of folks today. Living that kind of a life surely stocks up your fund of patience anyhow.

Consequently, I feel as cheerful as a fly on a bald head when cool and rainy seasons arrive post-paid from the Weather Bureau. I know that the drainage is par-excellent on the sand farms and that the light soils will catch and retain what solar warmth and energy there is. I know that my old chums will get a little gravy along with their grits for one season anyhow.

I climb a scrub oak knoll where my parents sleep among the sand-land sedge and cedars, and I gaze across their homeland valleys at "time and the river." Stern modern economics decides that their lives were wasted on neglected submarginal soils. Science has since opened new vistas and old errors fade as trained youth enriches the land of our patient fathers.

Yet knowing all these to be signs of a better day, a broader life, and a surer hope, I still believe that no chemistry, no laws, and no labor can prepare an abiding place of more lasting spiritual security than our humble home-makers established in that land of drouth and nubbins.

The real harvest of the sands cannot be weighed at the bins. Devoted memory takes the measure.

NO CONSIDERATION

Two gangsters were escorting a member of a rival gang across a lonely field on a dark and rainy night.

"What rats you are," grumbled the doomed one, "making me walk through a rain like this."

"How about us?" growled one of the escorts, "We've got to walk back."

Father: "Isn't it wonderful how little chicks get out of their shells?"

Son: "What gets me is how they get in."

An American staying in a London hotel was introduced to an Aberdonian, who asked him: "And what country do you belong tae?"

"The greatest country in the world!" replied the American.

"Man! So dae I," replied Sandy, "but you dinna speak like a Scotsman."

Bluenose: "Pardon me, young lady, but in the matter of your dress, don't you think you could show a little more discretion?"

Flapper: "Migosh, some of you guys ain't never satisfied!"

Teacher in geography class: "Where is Detroit?"

Young Ike: "In Chicago playing the White Sox."

Doctor: "You must avoid all kinds of excitement."

Male Patient: "But doctor, can't I even look at them on the streets?"

Most women would be cured of jealousy if they would only take one good, steady, and impartial look at their husbands.

Little Bobby, aged seven, came into the house looking somewhat puzzled.

"Mother," he said, "why is it some people are so rich and we're so poor?"

"I guess it's just God's will," she replied.

Bobby pondered a moment and then asked: "Why weren't we mentioned in God's will, mother?"

ADEQUATE REVENGE

"Ye say ye blackened his eye, Pat?"

"Thot's whot O'i did. Sure, O'i got a fish bone stuck in me throat, an' not contented with seein' me suffer thot much, he commences beatin' me back."

PITY THE GROOM

"What does the bride think when she walks into the church?"

"Aisle, Altar, Hymn."

A mountain man who rarely, if ever, visited a town of any size, came to a city with his son, traveling in a rattletrap car.

Climbing out on one of the main streets, the old man appeared fascinated by the pavement. He scraped his feet on the hard surface, and, turning to his son, remarked:

"Well, I don't blame 'em for building a town here. The ground is too darn hard to plow, anyhow."